DOCUMENT RESUME

ED 225 665 PS 013 315


AUTHOR Flynn, John P.; And Others

TITLE Computer-Assisted Instruction as a Training Methodology for Child Placement Licensing Staff.

INSTITUTION Western Michigan Univ., Kalmazoo. School of Social Work.


PUB DATE Jun 82
NOTE 86p.
PUB TYPE Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Certification; *Computer Assisted Instruction; Formative Evaluation; *Foster Care; Literature Reviews; *Participant Satisfaction; Program Evaluation; Questionnaires; *Staff Development; *Training Methods
IDENTIFIERS Michigan; Placement (Foster Care)



ABSTRACT

Results are provided from a formative evaluation of computer-assisted instruction (CAI) designed for training of foster home certification and licensing staff. The evaluation was undertaken to provide information on issues of feasibility, installation, and implementation of CAI. Project data were obtained from two sources: the first was a review and analysis of CAI literature, the second was a field administration of CAI lessons, followed by an evaluative questionnaire given to 29 workers from preselected child placement agencies in southwest and southcentral Michigan. The literature and field findings support the proposition that CAI is effective in teaching about licensing and regulation. Literature findings suggest that content allowing for narrow user discretion is more applicable to CAI than is content allowing for broad user discretion. Over three-fourths of the sample said the CAI lessons increased their knowledge base in the area of licensing and that CAI is a workable and practical way to teach some aspects of licensing and certification. The remaining one-fourth of the sample said they were not sure about the effectiveness of CAI, but no one indicated negative feelings regarding its use. These positive findings resulted in a call for further research on and development of the CAI system to include more areas of licensing training. Related materials, including organizational charts of the Michigan Department of Social Services, forms of the questionnaires used, and data tables are appended. (MP)



**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED225665

# COMPUTER-ASSISTED INSTRUCTION AS A TRAINING METHODOLOGY FOR CHILD PLACEMENT LICENSING STAFF

by

John P. Flynn, Ph.D.
Project Director

Margaret Dokter
Dale R. Hein
Terry Kuczeruk
Kay Loftus
Jon Manby
Peter Matchinsky
Robert Monsma
James Muller
Michele Rutherford

PS013315

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

John P. Flynn

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Field Studies in Research and Practice
School of Social Work
Western Michigan University
Kalamazoo, Michigan

June 1982

ACKNOWLEDGMENTS

The research team would like to express our gratitude to Mr. Harold Gazan, Director of the Bureau of Regulatory Services, Michigan Department of Social Services, Lansing, Michigan, who served as an invaluable source of support throughout the project. Because of the assistance of Mr. Gazan and the Bureau staff in laying the groundwork for this study, our task became more manageable.

We also wish to acknowledge Mr. Robert Bee, Director of the Division of Child Welfare Licensing, and the following consultants: Mr. Henry Saverson, supervisor, Mr. James Kinkema, Mr. Vernon Laninga, Mr. Nicholas Van Andel and Mr. Jerome Liebrecht for their administrative leadership and assistance in identifying potential training sites for our research pilot.

The team is deeply indebted to Mr. David Fitzgerald, Mr. William Shipp and Dr. Christopher Unger of the Division and Dr. John Flynn of Western Michigan University for their investment and expertise in developing the computer-assisted instruction (CAI) lessons presented in the pilot.

Acknowledgment is also made here of the contribution of administrative staff of the Bureau and of the Department's Office of Management and Staff Development for their comments provided in a discussion of the project's preliminary report.

We would especially like to express our appreciation to the participating licensing workers and administrators for their time, enthusiasm and cooperation in making themselves available for the CAI pilot experience. Their thoughtful feedback was highly regarded in our final analysis and recommendations.

A sincere and special thanks goes to Project Director, Dr. John Flynn, whose knowledge and expertise was so freely shared throughout the project. His commitment, diligence and long hours helped inspire the team to perform at our highest level. In addition, his dedication and leadership promoted the development of mutual respect within the group. This led to team cohesiveness resulting in a prime educational and professional experience.

The computer terminals were generously loaned by Ms. Linda Rolls, Waldo Library, WMU, and Ms. Jean Heathcote, College of Health and Human Services, WMU. Invaluable assistance in a computerized search of the literature was also provided by Ms. Rolls and Dr. Howard Poole of WMU's Office of Instructional Development.

Some out-of-town travel was provided by Western Michigan University.

Finally, to the secretarial staff of the School, we wish to extend our thanks for the hard work and assistance in delivering our final product.

## PREFACE

The following is a report of a group research project completed as part of the coursework in the graduate social work program in the School of Social Work of Western Michigan University, Kalamazoo, Michigan.

The course, SW 686 Field Studies in Research and Practice, is seen as an opportunity to integrate practice, theory and research skills while making a meaningful contribution to the field.

The research team consisted of a Project Director, social work faculty member Dr. John Flynn, and the following self-selected group of graduate students: Margaret Dokter, Dale Hein, Terry Kuczeruk, Kay Loftus, Jon Manby, Peter Matchinsky, Robert Monsma, James Muller, and Michele Rutherford.

Though considerable time was invested by the Project Director and the staff of the Bureau of Regulatory Services, Michigan Department of Social Services, prior to the course, the period of intense work occurred while students were engaged full time in the project from May 3 through June 23, 1982. This time constraint required the simultaneous completion of multiple tasks which normally would have been completed in sequence over an extended period of time and posed a special problem to be overcome by the research team.

TABLE OF CONTENTS


ACKNOWLEDGEMENTS . . . . . ii

PREFACE . . . . . iii

I. INTRODUCTION . . . . . 1

II. METHODOLOGY . . . . . 5

Introduction . . . . . 5
Background Information . . . . . 5
Philosophy . . . . . 5
Task Delegation . . . . . 6
Procedures . . . . . 7
Administration/Interviewing Process . . . . . 8
Evaluation . . . . . 9
Methodological Criticism . . . . . 10
Summary . . . . . 10

III. FINDINGS: REVIEW OF THE LITERATURE . . . . . 13

Introduction . . . . . 13
CAI: What is it? . . . . . 14
Issues for Planning, Research and Development . . . . . 18
Hardware . . . . . 21
Software . . . . . 24
Cost of CAI . . . . . 30
Human Factors . . . . . 34
Issues in Evaluation . . . . . 36
Summary . . . . . 38

IV. FINDINGS: REACTIONS FROM THE FIELD . . . . . 41

Introduction . . . . . 41
Profile of the Participants . . . . . 41
Participants' Attitudes . . . . . 42
Participant Characteristics and Attitudinal Responses . . . . . 45
Attitudinal Responses Compared . . . . . 47
Additional Comments . . . . . 47
Summary . . . . . 48

V. DISCUSSION AND IMPLICATIONS . . . . . 51

VI. ABSTRACT . . . . . 59

VII. APPENDICES . . . . . 61

A. Organizational Chart, Michigan Department of Social Services . . 61
B. Evaluation Questionnaire . . . . . 63
C. List of Tables . . . . . 69
D. List of Participants . . . . . 91

VIII. BIBLIOGRAPHY . . . . . 93

I

# INTRODUCTION

The purpose of this project was to conduct a formative evaluation of computer-assisted instruction for training of foster home certification and licensing staff. This evaluation was undertaken to provide information on issues of feasibility, installation and implementation of computer-assisted instruction (CAI). Presumably, the findings would apply not only to child placement licensing, but to other areas of licensing and certification as well (e.g., adult foster care and child day care staff training).

The Bureau of Regulatory Services (BRS)is under the auspices of the Michigan Department of Social Services within the Special Operations Administration (see Appendix A). It is the responsibility of the Bureau to license and regulate non-medical, out-of-home care facilities for adults and children. These responsibilities lie within the Bureau's three divisions ---the Division of Child Day Care Licensing, the Division of Adult Foster Care Licensing, and the Division of Child Welfare Licensing.

Through licensing and regulation the BRS annually serves to safeguard more than 600,000 vulnerable children and adults from potential exploitation and abuse because of age or disability (DSS Publication 369, Rev. 1982). Licensing serves as a means to minimize risks for vulnerable children and adults and fulfills the Michigan Department of Social Services' goals of the protection of children and adults unable to protect their own interests (DSS Publication 313, 1981).

Adult Foster Care is governed by Act No. 218, P.A. of 1979, which establishes the authority for the Department to regulate adult foster care camps, family homes, small and large group homes, congregate facilities and governmentally operated adult foster care facilities. Act 116 similarly establishes Departmental authority to regulate child care organizations. The eight types specifically identified are as follows: child care centers, child caring institutions, child placement agencies, children's camps, family and group day care homes, foster family homes and foster group homes. Act 116 also requires Department regulation of governmentally owned child care organizations (DSS Publication 369, 1982).

The Bureau has the large responsibility of training its own staff of supervisors and consultants in the field. In addition it has the responsibility of training child placing agency staff outside of the Department of Social Services, i.e., child placing agency staff who certify homes which are, in turn, licensed by the Department.

P.A. 116, the Child Care Organization Act, includes two rules which particularly pertain to training.

1) R 400.6135. Staff training.

Rule 135. The agency shall provide initial and ongoing

staff training for social service supervisors, social service workers, and social service aides related to their job descriptions. Training shall consist of a minimum of 8 hours per year and shall include information regarding current child placing practices and laws and administrative rules relating to child placing in Michigan.

2) R 400.6302. Authorization to certify homes.

Rule 302. To be authorized to certify that foster homes meet standards, an agency shall comply with all of the following:
(a) Meet the requirements in part 1 of this part or demonstrate an intent to comply with part 1 and this part where compliance can only be demonstrated after the agency has initiated operations.
(b) Assure that the agency's supervisor of the social service workers, or a designee, has received training in foster home certification from the Department.
(c) Have written procedures for assessing and certifying foster homes for licensure which comply with these additional provisions for foster home certification and which are approved by the Department (DSS Publication 11, 1980).

These rules provide the Bureau with the responsibility of training child placement agency licensing staff which the Bureau regulates. In order to comply with these rules, and in response to the recognized need for ongoing staff development and training, the Bureau began to examine its training activities.

Presently, training activities are carried out via the development and distribution of manuals and the provision of periodic training sessions at various sites throughout the state. This approach to training has proved costly in terms of Bureau and placement agency staff time and travel. In addition, it has generally not been possible to bring together Bureau and placement agency staff with sufficient frequency.

In 1980 the BRS began working with the School of Social Work of Western Michigan University in a collaborative effort to meet material needs in training, research and policy development. Over the past two years some tangible cooperative efforts have been:

1) An assessment of statewide staff attitudes and needs regarding training (SW 686 Field Studies in Research and Practice, Spring 1981).
2) A statewide survey of licensee satisfaction (1981).
3) A coauthored article for publication, "Licensing Out-of-Home Care: a Non-service Approach to Prevention and Protection."
4) A workshop for statewide Bureau supervisors and administrators on "Supervising Professionals."
5) Use of the BRS as a field site for field education for graduate social work students.
6) Lectures provided by the Bureau staff to various campus groups.

Due to the joint interests of the BRS and WMU in research and training, together they began to look at innovative and efficient methodologies. The Project Director's experience with CAI, coupled with the appeal of CAI's prospective cost effectiveness in an inflationary economic climate, made CAI an option to be examined.

It was felt that research was needed in order to help the Bureau systematically approach CAI as a method of training. Hence this project, Computer-Assisted Instruction as a Training Methodology for Child Placement Licensing Staff, was developed as a means of generating questions, raising issues, and providing knowledge and information which may guide the Bureau in important decisions to be made in the future regarding resources and technological advances in staff development and training.

II

# METHODOLOGY

## Introduction

Discussion of the methodological approach to the pilot project in computer-assisted instruction is presented under the following sub-headings: background information, philosophy, task delegation, procedures, administration/interviewing process, evaluation, methodological criticism, and summary.

## Background Information

This pilot project in computer-assisted instruction (CAI) was designed to evaluate the feasibility issues of CAI and the attitudinal reactions of agency licensing and certification specialists to CAI. Three separate CAI lessons were designed in collaboration with Michigan's Bureau of Regulatory Services (BRS). They center around aspects of licensing and certification for child welfare placement agency staff. These lessons, developed during the period from January 4 through April 16, 1982, were administered to licensing and certification specialists from May 19 through June 3, 1982.

In order to successfully conduct this pilot project, it was necessary for the research group to acquaint itself with the functions and objectives of the BRS. Mr. Harold Gazan, Director of the BRS, and Mr. Dave Fitzgerald, Assistant Director of the Division of Child Welfare Licensing, came to WMU to aid the group in understanding the Bureau's objectives as well as its relationship to the pilot project.

Project staff also needed to formulate objectives and gain expertise in a variety of areas. A number of tasks that had to be undertaken were: appropriate and cogent familiarization with the literature on CAI, scheduling appointments with agency staff to administer the lessons, designing a questionnaire (see Appendix B), learning necessary computer usage and computer terminal procedures, processing, coding, and analyzing the data and constructing our final report.

## Philosophy

It was important for the purpose of successfully completing and analyzing this project to clarify the underlying philosophy on which the project was based. This philosophy, a foundation for the methodology to follow, might best be viewed in the context of three research processes: organizational development, peer consultation, and action research (Flynn, 1982).

First, the concept of organizational development stresses cooperation among administrative staff and consultants when considering organizational change and alteration. A function of the project was to cultivate and maintain a healthy autonomy in administration and staff ownership of its licensing and certification function. Also there is a need to communicate state policy in child welfare licensing and certification. The individualized format of project administration of lessons by individuals in the field, and the request

for specific agency-oriented feedback on the part of the licensing and certification specialists and administrators helped to fortify this needed autonomy.

Second, the unique format of the CAI lessons served as a consultative device with the respondent. The project's final analysis (to be reported later) relied heavily on worker feedback regarding CAI appropriateness and future use. The individualized structure of the lessons became a communication link between the project workers from WMU, and BRS staff, and the field agencies. Data analysis reflected that communication and served to validate the group's recommendations.

The third process, action research, called for the combination of scientific factfinding (e.g., computerized data analysis) with cooperative input from all parties involved (e.g., project members, BRS staff, and field agency personnel). The difficult task of preserving agency control over its domain, while providing a training experience based on official regulatory procedures, could not have been achieved without close and equal input from parties at all levels. The use of CAI as a training tool demonstrated welding of contemporary technology and the human need for education. The speed and efficiency of a CAI approach to training was positively reflected in cooperative feedback. The availability of sophisticated technology as a supportive and educational factor in human service delivery provided the initiative for this project and support for the concept surfaced as the project unfolded.

In reviewing the literature on CAI, the need to reflect the aforementioned philosophy was often stated and reinforced. The findings and resultant analysis responded to the need for shared collaborative input. The literature review will hopefully serve as a resource for the BRS and as an advocate for the aforesaid philosophical approach to evaluation and research.

## Task Delegation

In order to successfully achieve the desired objectives, the group agreed to delegate various responsibilities to smaller teams within the group. Often during the project, members of the nine person group had to take on more than one of the tasks outlined below in order for all of them to be successfully completed within the seven and one half week time period. One team was responsible for reviewing literature on CAI, extracting the resources relevant to the project and reporting back to the group with their findings. Another group had the task of scheduling appointments with the licensing and certification specialists at the participating agencies. The entire group then participated in the administration of the lessons and the evaluation/questionnaire in the field. Another team handled the analysis of the data gathered from the lesson administration, entering it into the computer for easy reference and analysis. The entire group participated in coding the evaluation/questionnaire for entry into the computer. Individual members had the function of writing up the various components of the report: introduction and abstract, methodology, literature review, discussion, statistical findings, charts and graphs and the bibliography. Another team had the responsibility of editing the various written components.

## Procedures

Sampling for the project took on a unique two-fold procedure, i.e., agency selection and literature selection. One sampling strategy concerned the selection of licensing and certification specialists from area agencies. These specialists had expertise in child placement licensing and certification. The decision to concentrate on child placement agency staff was based on two considerations. First, P.A. 116, the Child Care Organization Act, outlines in Rule 135 the requirement for staff training. Also of importance in selecting child placement agency staff was the need for a broader educational approach to staff training. Along with specific BRS policies and guidelines, there existed more generic educational needs, such as content in history, philosophy and principles in regulatory administration. In essence, it was determined that child placement agency licensing staff training should encompass both inservice and educational content.

Division consultants within the BRS preselected child placing agencies in the general southwest Michigan geographical area which they thought would benefit from the project and contribute meaningful feedback on CAI. This purposive sample, based on constraints of cost and budget, in no way represents the distribution of licensing and certification workers across the state. Letters were sent by Mr. Robert Bee Director of the Division of Child Welfare Licensing, to the agency administrators introducing the project and its developers. These cover letters served as the project staff's introduction to the agencies for scheduling appointments. The letters also requested notification of the appropriate licensing and certification specialists with whom the group was to make contact.

Due to cost and budget considerations, the impracticality of a random sampling of agency personnel became evident. Although such a purposive sample as was selected had its shortcomings, the group found it beneficial and efficient to rely on preselected agencies, using the good judgment of the consultants in making these selections as well as their direct and personal knowledge of the agencies involved. Project staff were grateful for this preliminary work on the part of the BRS consultants so that the project could reach the appropriate licensing and certification specialists.

The three CAI lessons administered during the project involved the following content areas:

COMPLA- Investigating Licensing and Certification Complaints

PSFOIA- Licensing, Protective Services, and the Michigan Freedom of Information Act

CLASS- Social Work and Regulatory Administration (Class, 1975)

All of the lessons are part of an overall set of lessons prepared in advance of the project, entitled CALCAL (Computer Aided Lessons in Certification And Licensing). CALCAL is a menu program accessible to the participants when taking the three lessons. It serves to acquaint the participants with the content of the three lessons, COMPLA, PSFOIA and CLASS. Each of these lessons required an average of 80 person hours for development.

The lessons, written in the authoring language GNOSIS, are designed to

involve the user on an individualized basis. They provide written text in the content areas followed by questions on the text. Correct answers are noted with a variety of personalized responses. Suggestions and explanations follow incorrect answers.

The second procedure in the sampling revolved around the literature review and analysis. A major purpose of the project was to explore the feasibility of and information on the installation of CAI. Those involved in the literature review had the task of identifying information on CAI pertinent to the framework outlined in the purpose statement.

The literature search was conducted through the Educational Resource Information Center (ERIC). The search covered the years 1976-1981 and identified approximately 850 citations of which 70-75 were selected. Resources collected covered a wide variety of CAI information:

1) Descriptions and Definitions of CAI
2) Planning Recommendations
3) Selection Characteristics
4) Information on Hardware
5) Information on Software
6) Language Capabilities
7) Information on Courseware
8) Costs
9) Human Factors (learner use and learner characteristics)
10) Author Use
11) Evaluation Techniques and Methodologies

The literature component not only provided the group with needed information on the usage of CAI, but hopefully serves as an information source for the BRS in evaluating the feasibility of CAI and its possible installation. Literature samples were purposefully selected in accordance with the project's needs and goals. Although incomplete in scope, the information sample gathered serves as an important resource for future CAI research.

A third procedure for data collection was a discussion with Bureau staff and interested parties on the implication of the project findings. This discussion followed an oral report to the Bureau by the project staff on the overall format and findings of the project. The oral presentation on June 18, 1982, summarized the components found in the completed written report. It also afforded the opportunity for questions and comments from the Bureau and other presentation participants.

It was hoped that the discussion would provide additional data on BRS reactions to the project and emphasize the implications of this project on CAI installation and implementation within the Bureau.

Administration/Interviewing Process

All group members participated in the field administration of the CAI

lessons. The process consisted of two members of the group, acting as a team, visiting an agency and administering the lesson(s) to child welfare licensing and certification specialists and those administrators who wished to take part. Occasionally, only one group member would administer the lesson(s). Twenty-nine agencies in a ten-county area were scheduled for visitation by an administering team from May 19 through June 3, 1982.

Each team carried a Texas Instrument Silent 700 portable computer terminal and questionnaires. The team met with the licensing specialist of the agency being visited in a quiet room that had access to a telephone. One team member introduced the participant to the project, describing the purpose of the project and its affiliation with the BRS and WMU. Stressed in this preliminary informational discussion were aspects of confidentiality and features of terminal usage. Questions by the respondent were addressed prior to, during and after administration of the lesson(s).

While one member introduced the participant to the project the other team member connected the terminal to the main computer at WMU. This was accomplished by a telephone connection between the terminal and the main computer. If the telephone connection was over long distance a credit card number was used to eliminate phone expense for the agency. The team member then logged in appropriately on the terminal and set the stage for the participant to begin the lesson(s) of their choice. Some participants elected to run the menu program CALCAL at this time to view the content of the three lessons (i.e., COMPLA, PSFOIA, CLASS). The participant was free to choose any or all of the lessons. The team then served in an advisory/support role while the person was taking the lesson(s), addressing questions about the usage of the terminal or the text itself. Participants worked independently with team members intervening only on request. Team members were trained in areas regarding computer shut down and terminal malfunction in case these skills were needed.

After the participants had finished they were asked to fill out an evaluation form which sought individual information, reactions to the experience and opinions on the feasibility of CAI as a training tool.

A key objective of the administration process was to gather data on the participant's reactions to the CAI experience. The teams attempted to quell anxieties about computer usage and the program itself used a personalized, paced format in content delivery to assist in easing these anxieties.

## Evaluation

The essence of the CAI project was the provision of information to the BRS on CAI feasibility and registering feedback from participants on attitudinal reactions to this approach. The purpose was not to determine whether the program works but to discern what CAI is and how it works (Kidder, 1981). The project is centered around acceptability of the process and a definition of that process and related alternative processes. Thus, a formative evaluation is required as an ongoing, data collecting procedure.

The project group designed an evaluation instrument (see Appendix B) to be completed by each participant immediately following their experience with their selected lesson(s). To achieve a comprehensive data gathering instrument,

the group initially formulated questions arising out of the literature review in the following areas: demographic, content, administrative, and experiential. It was agreed that these four areas would best incorporate categories of information needed for analysis of the CAI experience.

The format of the "CALCAL" evaluation intrument was divided into three sections. The first was demographic information requesting data on the lessons selected, prior licensing and certification experience, sources of training, prior computer experience, percentage of work time devoted to licensing and certification, and sex of the participant.

The second section consisted of attitudinal data constructed on a five-point Likert scale, with 5 the highest response and 1 the lowest. These questions concentrated on respondent attitudes toward computer usage, the feasibility of CAI lessons in training, the format and structure of the lessons, etc. Crosstabulation of demographic information with attitudinal results served as an important method in analyzing the data on reactions to CAI.

Third, the participants were asked to reply to three open-ended questions dealing with lesson improvement, future use of CAI, and any additional comments on the experience.

## Methodological Criticism

Methodological shortcomings could be linked to the relatively short seven and one half week time span in which to complete the project. Purposeful samples were drawn by BRS staff to lessen the burden on the group in working within the seven and one half week time constriction. Another observable problem was the limited geographical area from which the samples were drawn. A state-wide sample of agencies might have provided a more accurate evaluation of reactions to the CAI training. Regarding the literature review, practically no information was found on CAI as it related to licensing and certification (though this may be seen as a finding rather than a criticism). Further, there existed literature that the group was aware of, but that was not available for review. The limitations of the inter-library loan system also prevented timely access to references which might have proved pertinent to the project.

For reasons of practicality and availability, the TI Silent 700 equipment used in administering the CAI lessons seemed to meet our initial needs. Future hardware selection might dictate the use of more sophisticated equipment. The use of audio and graphic feedback might prove useful to the participant when taking the lesson(s).

Variables in the interview process, such as conducive or nonconducive environments in which to administer the lessons and agency receptiveness, could also be seen as inconsistent. However, our well planned evaluation/questionnaire, and our training in administering CAI appeared to enhance reliability.

## Summary

The methodology used in completing this project centered around the close

collaboration between the BRS and the WMU project group. Bureau staff laid the preliminary groundwork by selecting the appropriate state and private agencies applicable to the study. The importance of agency staff feedback in determining the feasibility of CAI as a training tool was a needed data source.

Members of the nine-person project group shared a variety of tasks necessary to successfully complete the project. They included administration of the CAI lessons, evaluating data, entering data into the computer, and writing and editing the various sections of the report.

The CAI content consisted of three lessons dealing with specific areas of licensing and certification and were administered to licensing and certification specialists in child welfare placement agencies.

Two forms of sampling were used: the preliminary selection of participating agencies and the selection of appropriate literature on CAI. These two sampling procedures were used to satisfy the dual nature of the project. Those dual objectives were to evaluate the feasibility of CAI as a training tool in licensing and certification by gathering feedback from licensing specialists and to compile literature resources on the subject to assist the BRS in making decisions on CAI feasibility, installation and implementation.

After administering the CAI lessons to agency specialists, the specialists were asked to complete an attitudinal questionnaire dealing with the feasibility of CAI and its future use as a training tool.

Problems inherent in the project particularly involved the limited time and the limited geographical sampling area. In closing, however, several major factors contributed to the project's positive methodological approach. Those factors were balanced input from Bureau staff, agency staff and the project staff, preliminary agency selection by Bureau staff and an extensive literature review of CAI.

III

# FINDINGS: REVIEW OF THE LITERATURE

## Introduction

The research, development and implementation of computer-assisted instruction (CAI) is an immensely complex and time consuming process. The topic includes a broad range of specific problems and issues which are common to all forms of computer managed data, as well as those which are peculiar to CAI alone. Compounding the complexity of CAI is the fact that computer technology, and CAI itself, are both constantly changing as a consequence of new technological and educational developments.

Against this backdrop is placed the unique situation of human service agencies, who must, in a continually shrinking economy, develop more cost-effective methods of administration and service delivery. If the present social and economic trends continue, as they are likely to do, the question for human service agencies in the 1980s and 1990s will be: "How can ever increasing social welfare needs be met with shrinking financial resources?" Or simply, "How can we do more with less?"

Of particular importance is the necessity for adequate staff training; on the one hand, the need for quality staff training will continually rise in order to meet the problems of society, while on the other hand, the dollars necessary to provide this training will be shrinking. In short, the conflict between needed staff training and the resources necessary to produce it is, and will continue to be, particularly acute. The use of CAI has been suggested as one possibility to provide this training.

The purpose, then, of this section of the project report is to provide a review of literature pertinent to the research, development and implementation of CAI. In many ways, this literature review does not fit the common usage of such reviews as suggested by more traditional research methods. More specifically, project members regard this review of the literature as not only a prefatory process defining the project method, but also, more importantly, a valuable source of information in and of itself. The primary concern in reviewing the readings is to fulfill the contractual requirements of the Michigan Department of Social Services' Bureau of Regulatory Services. This pilot project in CAI was administered for that agency and for their purposes; consequently, the review was directed by their needs. However, above and beyond this, project members hoped to provide a more generic product useful to any human service agency interested in developing CAI for staff training.

At all times project members tried to place themselves in the role of human service administrators asking the questions: "What do we need to know to develop CAI?" As members themselves were unacquainted with the substance of this complex field, they presumed the reading audience to be likewise. The literature is extremely technical, esoteric and highly abstract; and as a consequence, is not easily or quickly accessible to those untrained in computer science. This assumption has determined the final product. The review is a snyopsis of the state of the art and is designed to clarify as much of CAI as possible. It is hardly the last word in research and development of CAI. It

is, however, a primer from which effective planning strategies can be derived and from which human service administrators can approach the literature with more specific questions.

The literature review team began with a computer search of the literature which yielded a catch of nearly 850 sources, of which approximately 70 were found to be most relevant for this study. Most of the sources were journal articles found in the educational technologies field, none of which directly spoke to staff training in licensing and regulation, or for that matter, staff training in human service areas generally. Excessively technical and specific readings were avoided in favor of more readable and generic materials. The team did not concentrate on efficacy evaluations, since the project is not an efficacy test of CAI. However, they did review a few articles of this type and have included them in the bibliography. Readings that concentrated on more formative evaluations were reviewed, since this spoke directly to the nature of the project. These decisions regarding what to include and to omit were difficult; but the team was always guided by the basic questions: "What do we need to know to develop CAI?"

Findings have been organized under the following headings:

1) CAI: What is it?;
2) CAI: Issues in Planning, Research and Development;
3) Hardware;
4) Software;
5) Costs;
6) Human Factors;
7) Issues in Evaluation; and
8) Summary.

## CAI: What is it?

This section first presents a brief history and theory of programmed instruction as it applies to CAI. Second, technical terms are defined, including computer, large computer, small computer, hardware and software. Computer-assisted instruction is defined and described in contrast to computer-managed instruction. Finally, the advantages and disadvantages of CAI are presented and discussed.

In 1954 B.F. Skinner adopted the idea of a teaching machine because he saw great potential in its development. Skinner regarded the machine as an excellent tutor for five reasons: one, there was a constant interchange between the student and the program, thus making it possible for the student to remain alert and to sustain activity; two, the machine, by virtue of its program, insisted that the student master a concept before moving on; three, the machine presented only that material for which the student was ready; four, the machine helped the student to respond correctly by hinting, prompting and suggesting in an orderly presentation of frames; and five, the use of feedback to shape behavior and maintain student interest reinforced correct responses (Collagon, 1976).

Skinner developed a linear teaching program composed of a small set of logical steps leading incrementally through the subject matter, a program based on his theory of operant conditioning. Such an approach, Skinner argued, increased the propensity for correct responses because the student's response is conditioned and reinforced by the previous frames. Two techniques serve to reinforce correct responses: orderly construction of the problem and the use of hinting, prompting and suggesting (Collagon, 1976).

In the 1960s Norman Crowder developed the intrinsic or branching programmed instruction. Crowder argued that there were two shortcomings in the linear program. First, elimination of student error in instruction was both undesirable and impractical. Second, elimination of student error requires the program to be constructed with such small and simple steps that educational objectives will not be served. In short, Crowder saw in Skinner's approach too much busy work for the student (Collagon, 1976).

The intrinsic program consists of frames in the form of multiple choice questions and answers. The student is presented with a problem or question having several possible answers. Student's answers can be anticipated and material prepared for them in advance can be employed based on an answer to any particular question. If the student answers correctly reinforcement is given for the correct answer. If the answer entered is incorrect feedback is given to explain the error (Collagon, 1976).

Skinner and other proponents of the linear approach suggested that there are three dangers in intrinsic programming: one, there is a danger of overloading the student with information; two, not all incorrect answers can be anticipated; and three, intrinsic programming provides less opportunity for meaningful error than does linear programming (Collagon, 1976).

The use of the computer to provide instructional content directly to the student has, in many ways, resolved this controversy. The CAI program offers the best of both approaches. It provides the student with information to be learned as well as feedback to specific responses. The experience for the student becomes more individualized and the interaction between the student and the machine becomes more human-like. CAI therefore is the result of a marriage between the computer and programmed instruction (Collagon, 1976).

A computer is a machine that can receive and follow instructions in order to manipulate information. If the instructions (programs) given to the machine cannot be changed, then the machine is not a computer (Douglas, 1979). This is the essential characteristic of a computer which distinguishes it from other machines such as a calculator. A calculator is programmed to perform a set of predetermined functions. A computer, on the other hand, can be programmed and re-programmed to perform a wide variety of functions.

Hardware refers to the actual physical equipment that constitutes a computer or a computer system. This would include not only the computer itself, but also such things as a terminal, a printer and any telecommunications equipment (Douglas, 1979).

Large computers, sometimes referred to as maxi-computers or main-frame computers, are the largest and most expensive machines. They occupy large amounts of space, sometimes filling entire rooms, and their cost can reach

one million dollars or more. Computers of this nature are typically used by organizations to process massive amounts of information (Graham, 1980).

The maxi-computer should not be confused with a terminal. A terminal is an input/output device enabling the user to communicate with the maxi-computer. Usually a terminal consists of a keyboard with alpha-numeric characters and a printing mechanism (either a teletype or cathode ray tube). The user enters input information into the computer by way of the keyboard and receives output information through a terminal printer (Douglas, 1979).

Small computers, which include mini-computers and micro-computers, are complete computers within themselves. The mini-computer is a physically smaller machine than the maxi-computer and usually has capabilities less than the larger machines, though the mini-computer generally has time-sharing capabilities. The micro-computer, sometimes called the personal computer, is small enough to fit on the top of a desk or table. Micro-computers are built around micro-processors and first widely appeared in 1975 (Graham, 1980). Although they are a self-sufficient computer by themselves, many can also perform as terminals to larger computers. The user of a small micro-computer is apt to employ it for small, specifically defined tasks, as opposed to massive amounts of information processing (Bork, 1979). The term personal computer is used because these machines often perform personal accounting or business tasks. Their cost can range anywhere from $600 to $20,000+ (Joiner, 1980).

Software consists of the computer programs, the instructions given to the computer. Software is stored on magnetic tape or discs when not being used by the computer. When the computer performs an operation and the software is being used, the computer reads the software into its memory in order to utilize the programs (Douglas, 1979). Courseware is merely software of a specific nature; programs designed to deliver instructional material. Courseware and software are terms sometimes used interchangeably.

Computer-managed instruction (CMI) and computer-assisted instruction (CAI) are but two types of software programs. CMI is a program which enables instructors to employ a wide variety of instructional management functions such as scheduling of student activities and diagnostic operations. It is strictly a program for information management in education; that is, a device which an instructor uses to coordinate an entire educational program. In contrast, CAI is a program which provides for direct interaction between the student and computer (Ingle, 1976). The three pilot lessons in certification and licensing entitled "CALCAL" are primarily programs of CAI, though they do contain aspects of CMI.

The use of the computer as an instructional device is an outgrowth of the educational technology field. Educational technology employs a systems approach to instruction which includes specific, measurable instructional objectives, diagnostic testing criteria for student performance and repeated redesign of curricula (Schoen, 1977). These are all characteristics which CAI has borrowed and employed. According to Collagon, CAI is an outgrowth of S.L. Pressey's first programmed instruction (PI) (Collagon, 1976). S. L. Pressey, a psychology professor at Ohio State University, was the inventor of the first teaching machine and the author of the first machine program, a drill and practice routine based on multiple choice questioning.

It is useful at this point to look at some of the advantages and disadvantages of computer-assisted instruction.

Advantages of CAI:

1) Due to constant participation the learner is active and attentive;
2) By being able to move privately at their own pace gifted learners are not bound, slower learners are not rushed and shy learners are not embarrassed by incorrect answers given in public;
3) The computer is impartial, patient and objective;
4) The learner gets immediate feedback to answers given, enabling the learner to check progress and to produce responses which can be measured and evaluated;
5) The computer can secure, store and process information about the participant's performance prior to and/or during instruction to determine subsequent activities in the learning situation;
6) Due to more immediate feedback, computers produce more efficient learning and perhaps more highly motivated learners;
7) The learner can make up work missed;
8) The computer can provide greater flexibility in scheduling learning programs;
9) A few learners may take a programmed course where there are insufficient numbers to justify a conventional section;
10) Computers store large amounts of information and make it available to the learner more rapidly than any other medium;
11) Computers provide programmed control of several media such as films, slides, television and demonstration equipment;
12) Computers give the author or teacher an extremely convenient technique for designing and developing a course of instruction;
13) Computers provide a dynamic interaction between learner and instructional programmer not possible with most other media;
14) The computer can be used to achieve heretofore impossible versatility in branching and individualized instruction;
15) CAI forces or enables the author of CAI courseware to become more cognizant of the instructional process;
16) Computers have the ability to simulate real-life situations;
17) CAI provides a variety of learning opportunities;
18) The responsibility for learning is placed directly on the individual; and
19) The learner becomes aware of modern technology and can develop a sense of control over his/her learning environment.

Disadvantages of CAI:

1) In many programs the learner's efficiency in learning is dependent

upon reading ability and comprehension;

2) The teaching program is only as good as the material that goes into it;

3) Programmed instruction insists on deep and intrinsic learner motivation;

4) Learner encouragement, inspiration and stimulation becomes mechanical with machines;

5) Learners are unable to ask questions to clear up problems;

6) A learner cannot learn more than is programmed;

7) Good programming is time-consuming to prepare;

8) Hardware and the development of courseware are both costly investments;

9) There can be problems in finding personnel to develop courseware; and

10) There remains a question of cost effectiveness, i.e., are the outcomes worth the financial investment? (Collagon, 1976; Ingle, 1976)

In the list of disadvantages above, numbers 1, 2, and 5 can be eliminated by careful research and development of the courseware. The population for which the lessons are designed should do the lesson evaluations. In addition, occasional face-to-face meetings with small groups of learners improve and personalize CAI instruction. Regarding items 3, 4, 6, and 7, it would be safe to say that conventional textbooks or mediocre lectureres are no more effective than bad CAI lessons (Collagon, 1976).

Most of the issues cited in 8 through 10 concerning the negative aspects of CAI systems could be said to be problems that exist with any change. Hardware and software are expensive, but as technology advances the cost of materials will decrease. Improvements in programming languages have reduced the cost of producing programs and now make it feasible for authors of CAI materials to produce their own programs (Ingel, 1976).

When examining both the advantages and disadvantages of CAI and making comparisons between the two lists, it becomes apparent that most of the advantages are learner-oriented while many of the disadvantages are financial (Ingel, 1976).

To summarize, this section presented some introductory material regarding CAI and an historical context out of which CAI has developed. CAI was compared with another instructional use of the computer, namely CMI. Several basic concepts and terms were defined. The literature review team presented the advantages and disadvantages of CAI discussed in the literature and have drawn some conclusions from this discussion.

## Issues for Planning, Research and Development

Necessity dictates that quality research and planning play a fundamental role in the development of a CAI system. The need for planning is a basic tenet of any kind of organizational project, whether it is computer related or not. But the commitment in time, effort and resources that is required of an organization to develop CAI mandates even greater care in planning than

non-computerized projects would require. Though the benefits of CAI can be great, the potential pitfalls, if unanticipated, can place an organization in circumstances worse than when it started. For this reason we present this section of the report as an outline of essential planning, research and development issues; issues for human service administrators to thoroughly consider when proposing development of CAI. A particularly detailed report on the planning and development requirements found to be important in a five-year longitudinal study of the PLATO system by the U.S. Navy may be found in a report provided by Misselt, et al. (Misselt, et al., 1980).

Chris Dimas suggests that the first priority for CAI development is that an organization define and clarify the role it wishes to perform in an educational program (Dimas, 1978). This should come in the form of a policy or purpose statement, the importance of which will be to give direction to all aspects of CAI development. For example: should CAI be treated as a supplement to a broader range of instructional methods, or should it become the sole means of instruction? An answer to a question of this type will determine many things, not the least of which is cost, as well as the type of hardware and courseware to acquire. The advantages of such policy statements cannot be over-estimated.

Diane Essex and William Sorlie have provided an excellent list of recommendations for planning of CAI (Sorlie and Essex, 1979). The literature review team has condensed them and they are presented as follows:

1) A six month, funded start-up phase for planning and recruitment is recommended. The task of defining the operational goals of the project must be completed early in this phase. If existing personnel will not be used, personnel recruitment must be undertaken at this time. If the decision is made to use existing staff, they must be provided with any necessary training in computer usage and instructional methods. Ultimately, project staff must be hired or trained, or some combination of both. Finally, input from user groups must be solicited, an important part of the process since it not only generates important design information, but it also lays the groundwork for successful implementation by giving the user groups a sense of ownership in the CAI system.

2) The resources needed to meet the objectives of the project must be identified and provided. The authors break this down into three caregories: staff requirements, hardware requirements and software requirements. Special attention should be given to defining the qualifications of project staff, a subject hinted at in the first recommendation. This issue will likely create a basic policy conflict requiring some form of resolution. More specifically, this conflict can be stated in the form of a question: "Should the lesson authors be content specialists or program specialists?" If program specialists are opted for, they must be trained in the course content and objectives. If content specialists are opted for, they must be taught to program and create courseware. Resolution of this issue can take many forms. For example, many high-level "authoring" languages exist which can allow content specialists to program courseware much more easily than if using lower-level programming languages (Rudnick, 1979). Another solution may be to hire a CAI or programming consultant to assist content experts in creating courseware.

Hardware and software must be selected, both of which will have effects on staff hiring and/or training. If an existing administrative computer is not used, a choice must be made from a wide variety of available types and brands of machinery at widely varying costs. The best way to approach this issue is to match organizational needs and resources with the varying capabilities of the large main-frame computers, mini-computers and micro-computers.

Selection of software will be a separate but related task to selection of hardware. Cost, capability and ease of use will be primary considerations. A wide variety of programming languages exist: commercially produced software, often accompanying specific computer brands; in-house produced software; and software provided by programming firms (Schoech, 1982). Software is an expensive proposition and many an organization has purchased hardware without realizing that programming is another major financial commitment. The result of such a lack of foresight is the acquisition of a computer that is useless and will sit idle until it is programmed to perform functions.

3) Courseware design must not only relate necessary concepts and facts, but must also be presented in a useful and creative manner. Lesson authors who have prior teaching experience could be a valuable resource in this regard. For CAI to be successful it must be treated as an integral part of the educational process. This means that administrators must encourage their staff to utilize the CAI resource and staff must regard the courseware as a source of important information. Unless this occurs the lessons will go unused and the hardware will collect dust in the equipment storeroom (Daneliuk, 1981). Planning must accout for these considerations.

4) Evaluation of the CAI project must be provided for from the very beginning. The evaluation must be both on-going (formative) and end-product directed (summative). This will provide flexibility to the project and will facilitate any necessary alternatives that may present themselves. Such evaluations should review all aspects of CAI development, ranging from costs to the adequacy of lesson content.

Different agencies will approach these issues and recommendations in ways unique to their particular circumstances. Both the agencies' resources and needs will inevitably determine the nature of their CAI design. Though the specifics for each organization may be different, this list does suggest the key elements for effective planning of CAI.

Carole Bagley supplies a list of specific characteristics that must be rank-ordered for selecting any CAI system (Bagley, 1979). Each characteristic is subject to any agency's own rankings, which again depend on that agency's own needs and resources. The characteristics to be ranked are presented as follows:

1) Cost of hardware;

2) Cost of software;

3) Cost of telephone communications, if any;

4) Cost of courseware not contained in the software costs;

5) Ease for student use;

6) Ease for author use;

7) Maximum capability for student use;

8) Maximum capability for author use;

9) Message sending capability between student and teacher; and

10) Whether or not to use an already existing administrative computer to create CAI (called "piggybacking").

In the January 1979 issue of Educational Technology, Fred Splittberger developed a useful list of various CAI and CMI systems (Splittberger, 1979). Each system is presented with information about the system developer, system type (including a description of its basic components), services and applicability both to certain curricula and student types. This list is not an exhaustive one, though it does present information on some of the leading systems, and as such may be a helpful resource for some interested agencies.

In conclusion, a number of articles present important information concerning planning, research and development of CAI. We have summarized and presented the findings of a few such readings that we regarded as particularly relevant and helpful. The key point to remember is that quality planning for CAI should be seen as both a task to be completed in and of itself as well as an on-going process. This cannot be over-emphasized because it stresses the important role that planning plays in creating CAI.

## Hardware

The purpose of this section is to provide important information about computer hardware to prospective purchasers. Included are: one, definitions and descriptions of computer hardware; two, a comparison between the performance of large and small computers, particularly in regard to computer-assisted instruction use; three, special computer features to be aware of when selecting computers for CAI use; and four, the "ideal" set-up for CAI.

There are five basic components of a computer: the central processing unit (CPU), the memory (main and secondary), a mass storage device, a keyboard and a video display unit (VDU) or teletype (TTY).

The CPU is the heart of the computer and controls what the computer does. It carries out logical decisions, performs computations, makes calculations and directs functions of the entire system. These functions can be performed very rapidly in only fractions of a second. The CPU accomplishes these functions by means of small integrated circuits, the brains of the CPU, that execute instructions using the binary system. The binary system is based on the number "2" and represented by the digits "0" and "1." A bit, either a 0 or a 1, represents an on/off, yes/no, true/false choice for the computer. A byte, the basic unit of information in a computer, is a series of eight bits. A byte represents a character which is a single item such as a number, letter or graphic symbol that can be understood by a human being (Douglas, 1979).

The memory of a computer consists of the integrated circuits which store information. The main memory is located in the CPU and has small storage capacity but can read and write very quickly in order to communicate with the CPU. The secondary memory, or mass storage, has a larger storage capacity but reads and writes much more slowly than either the CPU or the main memory. Consequently, it must communicate with the CPU through the main computer. The secondary memory stores operational systems, programs and data when they are not in use. Unlike the information in the main memory, the information in the secondary memory is not erased or eliminated when the machine is turned off. The CPU calls the program requested by the user from the secondary memory to the main memory and makes the program available to the user. In this way, the primary memory speeds up the messages that are given to the CPU from the secondary memory.

The information in the secondary memory is stored in the mass storage device on either a hard disc, a tape cassette or a floppy disc. Technology is moving away from the cassette, thus making them obsolete in favor of the floppy disc (Joiner, 1980).

The keyboard and teletype or VDU (sometimes called a CRT--cathode ray tube) are those parts of the computer which are the most accessible and therefore most familiar aspects of a computer. These components of a computer system are not, in fact, components of the main computer itself and are sometimes referred to in computer terminology as "peripherals." The keyboard is the device used for typing information into a computer. There are two different kinds of devices that aid the computer when communicating with user. The first type of device is a teletype unit which provides a paper copy of the computer output. The second device, known as the VDU, has a display screen instead of the paper printout. The present technological trend is away from the paper output to the VDU (Bork, 1979).

There are three basic components to a large-frame computer system: one, the computer which contains the CPU, memory, and mass storage; two, the terminal(s) consisting of the TTY or VDU and the keyboard; and three, connections between the first two. There are three main disadvantages to using these large time-sharing computers. The telecommunications needed to link up distant terminals with the central computer may cost as much as several thousand dollars a year. Second, when terminal users are separated by distance from the main computer there is a potential that they will feel alienated from its functions. And finally, computer system down-time and busy signals encountered during times of high system use further promote user disenchantment (Joiner, 1980).

The personal computer, however, is a complete computer in itself and therefore does not suffer from the same disadvantages as the time-sharing systems. Personal computers have advantages of their own. The development of small integrated circuits has expanded the capability of personal computers and lowered their initial purchase price and maintenance costs (Joiner, 1980). It is now possible to interlink micro-computers with major computer systems via telephone lines. In other words, micro-computers can have the additional capacity for acting as terminals. Dial-a-Program, a new technological development, can be implemented with either a computer or a telephone answering service. This allows a program to be taken from a large computer and dumped

into the memory of a personal computer, a process that takes only a telephone call and a few minutes (Stahl, 1979). Bork writes that entire operating systems can be transported because of the small size of ther personal computer. System down time will affect CAI lessons and all else when using the large computers, a circumstance less problematic for the micro-computer. Furthermore, a time-sharing computer may require inter-departmental commitments to the use of a computer for CAI; a situation which the personal computer would effectively eliminate (Bork, 1979). Joiner suggests that the personal computer is much less mysterious to the user because of its compactness (Joiner, 1980).

However, Joiner notes three disadvantages to the use of micro-computers: one, there is a lack of CAI languages for micro-computer application; two, micro-computers have a limited ability to perform repetitive calculations; and three, they have limited ability to store and recall large data files. As mentioned earlier, engineering and marketing trends suggest that micro-computer capabilities will increase, however, while costs will decrease (Joiner, 1980).

The prospective buyer of a personal computer must be aware of several things. Micro-computers sold as blank slates must be programmed from scratch (Joiner, 1980). Telephone links to a large computer require acoustic couplers, which are devices necessary to permit signal passage between the two computers (Crease, 1977).

For best educational use the VDU should be capable of viewing alpha-numeric and graphic information (Bork, 1979). The text display (the number of characters that can be viewed on the screen at one time) must have ample capacity since a small text display is a definite handicap to the user (Bork, 1979). When accessing to time-sharing computers, attention should be given to response time. CAI suffers if output is continually interrupted or replies are slow in appearing (Crease, 1977). New hard discs for micro-computers can store up to 2,000,000 bytes and can access any point on a disc in a fraction of a second.

What does all this information imply? Bork writes:

> Going beyond this, we can ask whether [a personal computer] acting alone will be (particularly when one reaches large-scale production) an effective mechanism for developing the types of materials we are now considering. The answer is probably no. One needs many of the capabilities of a larger system in such activity. Hence, it is likely that development will take place in a distributed environment with both personal computers and a central machine. The central computer will be for massive storage of programs and other information for management, for early testing of the material, and for resources beyond the capabilities of individual machines (Bork, 1979, p. 10).

The handling of CAI by a personal computer inter-faced with a large-frame computer is "the ideal situation" (Crease, 1977, p. 48).

In summary, information has been presented from the literature pertinent to the selection of hardware for CAI. Hardware components were defined and

described. Features of the larger time-sharing computers were compared with the micro-computer. Finally, it was suggested that the "ideal system" for CAI would combine aspects of both the larger computer and the micro-computer.

## Software

In this section the distinction between the generic term "software" and the more specific term "courseware" is dealt with first. Second, an overview of computer languages and language types used for courseware program production is presented. Third, CAI staffs are defined and described. Finally, the CAI courseware creation process is discussed.

The term software refers to the computer's programs and accompanying documentation. Software is stored in a secondary storage area (e.g., cassettes or discs) when not being used. When the user requests a program, the computer reads the software into its main memory in order to use the program. A program is a series of instructions to a computer which causes the computer to solve a problem or perform a task (Douglas, 1979). CAI courseware is a type of computer program.

Seven modes of instructional use for computers exist: tutorial, drill and practice, problem solving, gaming, simulation, inquiry and dialogue. The tutorial mode presents facts, skills and/or concepts to the learner for the first time. Its emphasis is on the educational material and it is sometimes designed to evaluate the user's responses in order to modify the material to the user's level. In the drill and practice mode an individualized routine is provided which reviews and practices basic skills or concepts acquired through some separate instructional process. The user responds to questions concerning the skills or concepts, responses are evaluated and immediate reinforcement or feedback is given concerning the correctness of those responses. The user of the problem solving mode uses a computer language, such as BASIC, FORTRAN, COBAL or GNOSIS, to instruct the computer in how he/she would solve a problem. In the gaming mode the user learns gaming skills by interacting with the computer via a terminal. Each game operates upon specific rules which are programmed into the computer and are presented to the user. In the simulation mode the computer randomly selects "real life" situations that reflect exigencies that the user must overcome. The inquiry mode, based on the user's need and interest, consists of a data base of information and a strategy of accessing it in some logical pattern. The user searches the material, focusing on those elements which answer the criteria set forth in the data base. Finally, the usage-dialogue mode, in a highly developmental stage on the research frontier, allows the user to interact in the form of dialogue with the computer in the user's own language (Austin, 1978).

Because of the need to develop CAI in licensing and certification and because it will be necessary to update this information from time to time, it would be wise to consider the issues involved in such an undertaking. It is first necessary for the reader to understand what computer languages are and the types of computer languages available.

A computer language is a language used to communicate with a computer. Assembly or machine language is a programming language written in binary, octal or hexadecimal notation. Programs written in machine language do not

need to be translated in order for the computer to execute its instructions because machine language is computer language. A general purpose or high-level language (such as BASIC, FORTRAN, PASCAL, etc.) is symbolic. The instructions to the computer are represented by words or mnemonic devices which humans can understand. The translator, speaking both human and computer language, is the compiler.

Compiler language instructs a compiler to translate general purpose language into machine language (Douglas, 1979). An author language, such as GNOSIS, the language that the program CALCAL is written in, is a higher level language than a general purpose language. An authoring language is specially designed so that it contains instructions helpful to the courseware author and the instructional programmer. These languages are higher level languages since it would usually take several general purpose language instructions to carry out a single authoring language instruction (Schuyler, 1979). Authoring languages are sometimes referred to as "user friendly" (Leiblum, 1979, p. 8).

An author who is anticipating that a learner will be using a terminal and large-frame computer to run a program is well advised to use an authoring language to implement that CAI program. However, there is a lack of authoring languages for micro-computer use (Joiner, 1980). Therefore, the author of CAI programs must either learn BASIC, a general purpose language, or make some allowances for the micro-computer. Courseware houses which have the resources can create their courseware on large computers and then translate it into BASIC for execution on micro-computer systems. This gives them the advantage of the larger computer's speed and storage capacity during the authoring process while allowing marketing to the public on the much less expensive micro-computer systems. However, as micro-computer systems increase in speed and storage capacities, one can expect to see a number of authoring languages available on each processor (Schuyler, 1979).

Because authoring languages were created specifically for CAI use, BASIC is a comparatively limited and less effective language to use for CAI purposes. Since micro-computers are often a cost-saving option over the large-frame computer, and since investing in a terminal over a micro-computer could subsequently be a waste of resources if and when more authoring languages for micro-computer use are developed, the rapid rate of language development is a key issue here.

The issue of computer languages, as well as hardware and software issues, also has implications for the type of CAI staff that will be required by the Bureau of Regulatory Services to develop, institute and maintain a CAI program. A CAI staff is a unit providing some sort of CAI service such as content expertise, etc. On one end of the spectrum, a unit can be a single person who acts as coordinator or instructor for an outside network. On the other end of the spectrum, a unit can be a large group of CAI specialists (programmers, educators, psychologists, etc.) housed in a separate institute that provides service to an entire institution (Leiblum, 1979).

There are a number of factors affecting the organizational structure of a CAI staff. The organizational structure refers to not only the personnel involved in the unit, but also the location of the unit in the larger organizational structure. A CAI staff will be either centralized, serving the entire

institution, or decentralized and locally based, serving restricted populations. The following list of questions emphasize the factors affecting the organizational structure of CAI staffs:

1) Most importantly, will the staff serve an advisory or consultant function to administrative developers?

2) Will the staff design new program materials and/or help evaluate existing materials?

3) Will the staff design or implement a CAI language or improve an existing one?

4) Will they provide training for instructional programmers conducting workshops or seminars?

5) Will staff maintain, revise, or improve existing CAI systems?

6) Will staff administer to physical facilities and/or coordinate computer or terminal use?

7) Will they translate, administer or evaluate "foreign" program products?

8) Will they maintain print, non-print, or program reference libraries?

9) Will they provide partial subject matter expertise?

10) Will they provide user record-keeping service and/or analyze performance? and

11) Will staff provide demonstrations and/or handle information dissemination? (Leiblum, 1979)

Some advantages to a centralized versus a decentralized staff are:

1) Less redundant efforts;
2) Reduced expenses;
3) Access to CAI specialists;
4) Easier sharing of materials;
5) Increased user populations; and
6) Better administrative support to advance their arguments.

Some disadvantages to a centralized agency are:

1) Bureaucratic and political conflicts;
2) Less control by users;
3) Communication difficulties;
4) More difficult access to subject matter specialists;

6) Great initial budgetary costs; and

7) Greater loss of time and data when breakdowns occur (Leiblum, 1979).

A decentralized staff offers close proximity to content specialists for courseware development but may lack didactic specialists (i.e., educational technologists to aid in program development and evaluation). A decentralized agency will simply offer fewer services than a centralized agency.

CAI staffs have been known to be placed within four main structures. The first is an educational structure and the CAI staff is affiliated with an academic faculty. The second is a computer service agency. The third is an educational research development or audiovisual learning resource type institute. The fourth is an independent unit reporting to a steering committee. The steering committee oversees the policies or activities of the CAI staff. All have proved to be equally effective (Leiblum, 1979).

CAI staffing depends on five factors:

1) Type of institution where CAI is to be used;

2) Amount of available funding;

3) Individual talent and skills;

4) Nature and size of user population; and

5) Complexity of subject matter (Leiblum, 1979).

There are two types of CAI staff extremes. The first is the "courseware factory," which consists of a large, specially trained group of instructional specialists. The positions in this agency include instructional psychologists, educational technologists, subject matter experts, authoring assistants, packaging specialists, instructional design technicians who determine the instructional validity of the developed materials and additional part-time computer specialists and AV design technicians. On the other extreme, a CAI staff can consist simply of subject matter experts who have received some training in CAI program techniques using authoring languages. The majority of these programs, however, have been found to possess poor instructional quality because the authors of the program lacked sufficient didactic and CAI programming experience.

A happy medium between these two is a staff consisting of content specialists, backed by support personnel, used for material preparation. This team would include the content matter specialists, instructional programmers and educational technologists with part-time support from AV consultants and computer specialists. A staff is needed to develop a CAI program because one person does not possess all the necessary skills to do so. "It is also a fact, however, that a single, enthusiastic master teacher given a minimum of instruction in the usage of an appropriate CAI system can produce a high quality instructional program" (Leiblum, 1979, p. 10).

It is important for an institution thinking of hiring a core CAI staff to remember that the CAI service objectives (the type, depth, and scope of services offered by a CAI staff) play a vital role in determining staff

requirements. Additional staffing needs will then be determined by institutional production philosophy, service objectives, subject matter, complexity of CAI strategies used and facilities provided by the system (Leiblum, 1979).

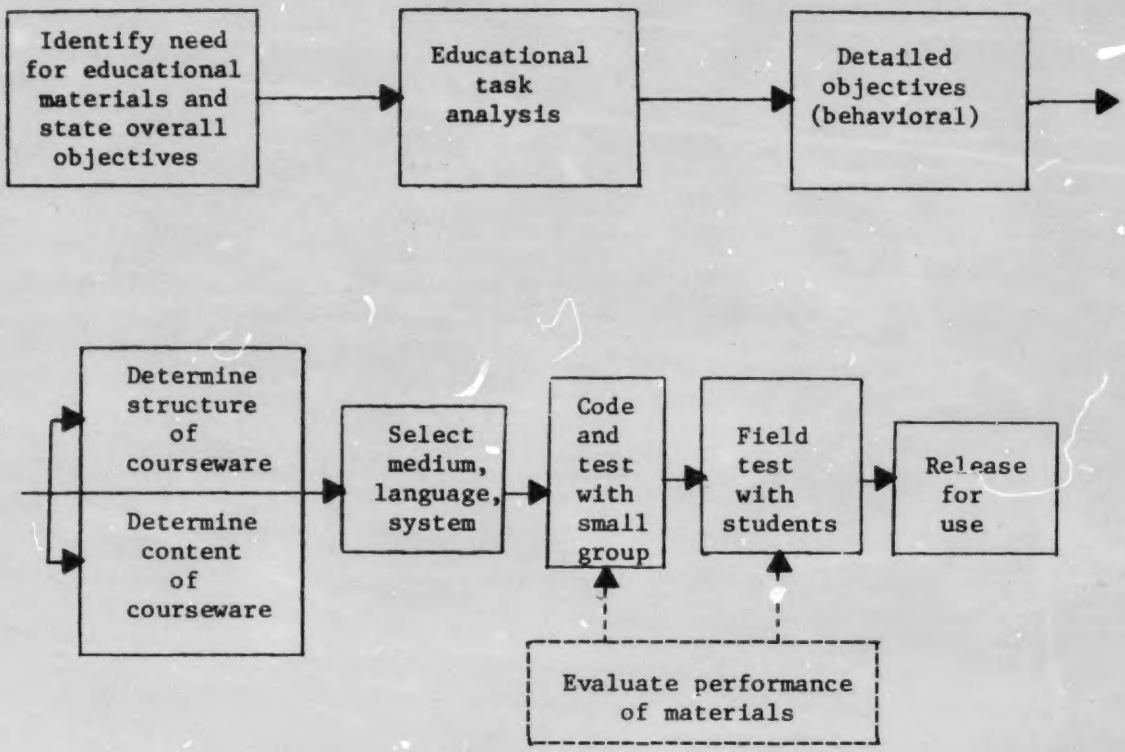
"The planning stages of courseware creation are, of course, the most critical. It is in these stages that the decisions are made which determine the structure of the computer program to be written; the program can then be built in such a way that it accurately reflects what the author feels is required to teach the topic" (Schuyler, 1979, p. 29).

Three essential characteristics of all programmed instruction, identified in the history of CAI, are first, that there be an interaction between learner and material and immediate feedback which informs learners of the adequacy of her/his response. Second, the subject matter to be presented is composed into a program (set of instructions to the learner). Third, it is composed of a series of items referred to as frames (a unit of the program which requires a response from the learner). The information needed to correctly answer a given item must be contained either in that item, in the preceding items or in both (Collagon, 1976).

Going a step beyond programmed instruction, the author of CAI courseware should become aware of the "systems approach" for designing instructional materials. This approach includes: one, identification of educational needs; two, behavioral objective formulation; three, strategy selection and sequencing; four, media selection; five, instructional preparation; six, evaluation of learning objectives and materials; and seven, reworking defective parts (Ingle, 1979).

During the third phase, strategy selection and sequencing, the author must decide what instructional methods are important and how they are to be sequenced. The fifth phase, instructional preparation, refers to building the actual program. Once the final program has been tested during the sixth phase, evaluation of learning objectives and materials, defective parts must be identified and revised during the seventh phase, reworking defective parts, which may include reevaluation and reworking of all system steps (Ingle, 1979).

Schuyler sees the courseware creation process this way:


Identify need for educational materials and state overall objectives
Educational task analysis
Detailed objectives (behavioral)
Determine structure of courseware
Determine content of courseware
Select medium, language, system
Code and test with small group
Field test with students
Release for use
Evaluate performance of materials

(Schuyler, 1979, p. 30)

The purpose of courseware evaluation is simply to improve courseware and to establish its effectiveness. There are seven methods of evaluation commonly used (Crease, 1977):

1) Learner interviews;
2) Learner feedback sheets;
3) Pre/post-tests;
4) Questions within the program;
5) Computer monitoring (records learner controlled inputs as a function of time and produces them as a table for study);
6) Staff interviews; and
7) Close observation of package use (enables an observer to record what the learner is saying as well as typing, giving insightful clues to weaknesses in the package).

There is no simple way of evaluating a CAI program. A general impression should be formed based on several sources. Interviews should be the most influential sources of information. As the program stops changing rapidly, interviews whould be replaced by learner feedback forms which will maintain a check on the use of the program. Pre/post-tests are difficult to construct

and may not be necessary to a complete evaluation. If they are used, they should be short so they will not inconvenience the learner, but they should be penetrating and pertinent to the program (Crease, 1977).

A person who is interested in developing CAI courseware should keep the following suggestions in mind:

1) Develop and keep long range goals;
2) Be imaginative (don't be confined to what has been done);
3) Work with groups if possible;
4) Do not start at square one;
5) Consider pedagogical problems independently of programming problems;
6) Revise your program;
7) Avoid BASIC if possible; it is not good for complex materials;
8) Avoid today's minimal systems; and
9) Avoid tape cassette-based systems. (Bork, 1979)

Courseware, then, is a specific type of computer program created for computer-assisted instruction use. Authoring languages were created specifically for writing CAI programs and therefore are the most efficient type of language to use in the courseware creation process. Courseware is created by a CAI staff and the issues involved in developing a CAI staff were cited above. Finally, it should be kept in mind that the authors of courseware should use the systems approach in the courseware creation process.

## Cost of CAI

This section of the literature review addresses the cost of CAI. Cost has obvious importance in the design and implementation of CAI and is perhaps the prime concern for human service agencies when considering installation of a CAI system.

Human service agencies must remember that cost estimation for CAI is a very difficult topic to address (Spuck and Bozeman, 1978; Bozeman, 1979). Patrick and Stammers have attempted to address the issue of cost when they cite Seltzer. Seltzer claims that employing the computer for instruction involves judgments based on the following three criteria: one, if the computer provides a unique and effective approach to the instructional process, then it should be used regardless of the cost involved; two, if the computer is a more efficient instructor than a traditional approach, and the cost of its use is minimal, then it should be used; and three, if the cost of CAI is relatively high, while its effectiveness is only marginal, then the computer should not be used for instruction (Patrick and Stammers, 1977). These three broad criteria may provide human service agencies with some direction in considering the cost of a CAI system. Having presented this very general approach to cost consideration, what kind of specificity can be extracted from the literature?

In particular, cost estimation of CAI must include hardware, software,

courseware, logistics, telecommunications, personnel training, research and development issues and any potential "hidden" costs. The emphasis placed on each issue will vary from unit to unit, depending on such things as the purpose of the CAI system, and how many of the costs have already been absorbed. For example, if a unit already employs an existing administrative computer, as does the Michigan Department of Social Services, this might eliminate some costs and pre-determine the existence of others.

The cost of hardware is a question that can be framed in the context of the basic computer types, i.e., the main-frame or maxi-computer, the mini-computer and the micro-computer. Daneliuk and Wright advise that prospective use of CAI hardware be determined only after research and evaluation comparing the cost of the main-frame, mini- and micro-computers (Daneliuk and Wright, 1981).

Four case studies of cost estimation for CAI hardware were reviewed. These case studies may prove to be useful references for a unit analyzing hardware components within CAI cost estimates. The first case study estimates the hardware cost of PLATO IV, a system using a main-frame computer and primarily designed to deliver instruction in a variety of university subjects (Kearsley, 1977a). The central computer and 4,000 plasma terminals are the hardware components in the PLATO IV annual cost estimates. The costs are based on an assumption of 2,000 hours of annual use per terminal.

The second case study estimates the hardware cost of the TICCIT system (Kearsley, 1977a). This system is comprised of a mini-computer and 128 terminals, thus making it a much smaller system than PLATO IV. The hardware components in the TICCIT system include a main processor, a terminal processor, a card printer, a line printer, a tape unit, disc drivers, a disc control, a CRT terminal, a computer-computer link, a character generator, a keyboard interface, an audio response subsystem, TV monitors, keyboards, refreshers, a signal processor, refresher controls, video tape players, TV modification, a crossbar switch and cabinets.

The third case study estimates the hardware costs for the Computer Curriculum Corporation (CCC), a mini-computer based CAI system that provides supplementary instruction in basic skills for reading, arithmetic and languages. The hardware components of CCC include a central-processing unit and eight terminals. The expected life span of eight years is an additional consideration (Kearsley, 1977a).

The fourth and final case study estimates the hardware costs for the Division of Educational Research Services (DERS) at the University of Alberta. This IBM 1500's annual costs estimate did not include specific hardware components (Kearsley, 1977a).

As a further guide to considering the hardware costs of micro-computers, the prospective purchasers should ask the following questions: one, will the micro-computer serve as a terminal in a time-sharing system? Two, how many micro-computers will be needed to adequately serve the projected level of use? Three, what is the anticipated life span of the hardware? And finally, how should the expenses be amortized? (Joiner, 1980) These questions can also be re-phrased to apply to the possible purchase of both the mini- and main-frame computers.

The hardware cost estimations for CAI are relatively easy in comparison to cost estimations for the other categories, though estimation of hardware cost is by no means simple. Relative to other aspects of computer systems, software expenses have been steadily increasing over the past thirty years. Software made up 15 percent of the total cost for a computer system in 1955. It rose to 75 percent in 1977 and projections for 1985 place it at 90 percent of the total cost (Schoech, 1982). The reason for this increase is no simple issue; but generally speaking, it is due to a decrease in hardware costs and a greater demand for a variety of software items (and, consequently, a greater reliance on personnel as opposed to machinery).

According to Schoech, there are three major sources of software: one, pre-manufactured software accompanying certain brands of hardware; two, in-house developed software; and three, professional software firms (Schoech, 1982). Programs manufactured to accompany hardware are specifically designed for use with those particular computer systems. In-house programs are self-produced by an agency or organization. Professional software firms design programs contracted for by organizations or agencies. Choosing a source of hardware, it should be noted, is an important cost consideration for software as well and must inevitably be faced when designing a CAI system. One word of warning: good quality, pre-manufactured software for use in the human services is not readily available; consequently, agencies must be wary of purchasing such products unless they are absolutely sure of acquiring what they need.

The use of in-house software involves cost considerations primarily in terms of personnel. Who will create the programs and write the lessons? Will training need to be provided for the personnel, and at what cost? How many hours will be required to develop lessons, and at what cost? If a programming consultant must be hired, how much will it cost? Hebenstreit speaks to some of these issues in his study on the costs of 10,000 micro-computers in French secondary schools. His findings revealed 50 percent of the initial costs were for training the teachers in programming and 25 percent for hardware. Thereafter, 70 percent of the costs consisted of staffing, teacher training and program writing. He estimates 100 to 300 hours are needed to develop one program (Hebenstreit, 1980).

The key question for the use of software provided by a professional firm is, "Can such a program be produced at an expense less than an in-house program?"

The evaluation of software cost is difficult to address and varies from unit to unit. Some underlying assumptions for software costs are suggested by Kearsley. His list includes expenses for purchasing or renting the CAI system, course authoring languages, graphics and/or audio software and utility programs. Kearsley claims that these costs are frequently excluded from cost estimates, either because they are too difficult to project or because they are assumed to be negligible. Any assumption that these costs are negligible is not only unfounded, but also foolish. Kearsley makes his point by giving examples in the case studies, the same case studies cited earlier in the context of hardware costs. Of the four case studies, only one provided a cost estimate for software (Kearsley, 1977a). Clearly, however difficult cost estimations for software may be, they must be faced by a unit considering installation of CAI.

Courseware, the instructional programs themselves, imply costs over and above that of the more generic category, software. Once the instructional program has been developed, it will periodically need revision due to a number of circumstances. For example, new developments in the content field will outdate lessons. It is a serious mistake to assume that once a lesson is in place it will no longer need inputs of time, money and energy. Another mistake is the omission of cost estimates for producing adjunct materials, such as manuals on computer operation, or supplementary instructional materials (Kearsley, 1977a).

The literature indicated that logistical questions and telecommunications are two other categories that must be factored into cost estimates for CAI. They are both topics often overlooked. Logistical costs include such things as transporting a CAI system from place to place or equipment distribution. Who will distribute the equipment? How will it be distributed? Who will receive equipment? What will the cost be? (Joiner, 1980) Telecommunications costs are often counted as user costs and therefore excluded from overall cost estimates. "Telecommunication costs involve simply the transmission costs via voice-grade telephone lines, digital data networks, microware, UHF television or satellite transmission." (Kearsley, 1977a, p. 101) If the use of telecommunications will be necessary, an agency must determine what services and equipment (modems, etc.) will be needed, as well as their cost.

The task of research must also be factored into cost estimations for CAI. Production of discussion papers and/or evaluations of the various components of a system will necessarily entail costs. Generation of user feedback, a vital part of the CAI development process, will also produce costs; such things as design and implementation of questionnaires will mean additional expenses. Cost estimates should always be balanced against alternative modes of instruction (Kearsley, 1977a).

Inter-agency or intra-agency distribution of cost is often employed by organizations utilizing CAI. In principle, this approach seems to have merit; however, in practice it can create many problems. This can be a consequence of technical and "political" issues. Courseware is not easily transferred from system to system if two agencies have different hardware. The lack of standardization of systems may require considerable writing and re-writing of courseware, even when transferring material to supposedly "identical" systems. The "political" reasons include intra-agency and inter-agency rivalries, copyright and royalty problems. Such problems can prove to be formidable barriers and may, in fact, effectively eliminate any cost savings hoped for from a joint venture.

Finally, agencies must be aware of an entire category of "hidden" costs. Often overlooked are the available service provisions from system manufacturers. What manufacturer services are avilable for the hardware? What will the cost be? Will service be readily available? Where is the service facility located? (Joiner, 1980) Operating costs, such as personnel salaries, must also be considered. Further, all cost estimates must allow for the effects of monetary inflation. Though this list of "hidden" costs is not exhaustive, it does serve to alert the potential user of CAI to some possible, unanticipated expenses.

In summary, the literature revealed cost estimations for CAI to be a

difficult and complex task; but a task that must be accomplished to develop any CAI system. Costs can be divided into convenient categories: hardware, software, courseware, logistics and telecommunications, personnel, research and development and potential "hidden" costs. If no other points are remembered, it is imperative to remember this: relative to all other costs of any computer project, software has been continually rising and makes up the majority of cost considerations.

## Human Factors

A human service agency contemplating the use of CAI must consider the human factors. Learner use and author use were the two main human factors identified. Learner use includes information on learner characteristics, learner personality characteristics and recommendations to facilitate learner use. Author use includes information about CAI system capabilities requiring different levels of author skill and how to utilize the author's creative abilities.

A good CAI system accounts for learner characteristics by maximizing strengths and minimizing weaknesses. But no current CAI system has the sophistication to use all the possible information on learner characteristics to provide individualized instruction (McCann, 1981). Therefore, the gathering of such needed information becomes the responsibility of both the designers and implementers of the CAI system.

Learner characteristics consist of prior knowledge of lesson content, prior knowledge of the computer and the learner's visual, verbal and mental abilities. If the learner has little prior knowledge of the lesson content, appropriate instructional support to provide help in answering content questions is needed, while an advanced learner would become bored with excessive support. If the learner has prior knowledge of the computer, that learner will tend to be less apprehensive of its use and therefore will make better use of CAI. If the learner's visual and verbal abilities are poor, elaborate visual and verbal representations will need to be provided (Carrier, 1978). Individuals with high mental ability benefit more from CAI presentations "that are perceptually complex, of fixed pace, informationally laden, in multi-channel motion pictoral forms (movies and televisions)" than the individual with low mental ability (McCann, 1981, p. 138).

It is important to consider three learner personality characteristics: psychological factors, apprehension factors and the degree of learner motivation. Bozeman used Jungian concepts of perception and judgment in a study of the Wisconsin System for Instructional Management (WIS-SIM). He measured the following factors: one, apprehension toward use of human-machine systems; two, confidence in WIS-SIM; and three, perception of usefulness of WIS-SIM.

Bozeman found that extroverts more readily use the computer because their main interest is in the external environment of people and things; consequently, they are more receptive to information, ideas and conepts that may be learned from CAI. Introverts, on the other hand, are less receptive to external sources of information and concepts; and consequently, are less likely to make effective use of CAI. Students with extrovert and cognitive tendencies had more confidence in the WIS-SIM than introvert and affective oriented students. The extrovert/

cognitive students found WIS-SIM more useful because, typically, they tend to be analytical and methodical and they respect that which is rational and objective. As a result of these findings Bozeman suggests that CAI decision makers must have a more complete understanding of psychological types of learners for CAI use. This must include both research and implementation of the necessary information (Bozeman, 1978).

Student apprehension is often a result of anxiety with the hardware. This anxiety stems from two sources: one, the rapidity with which the computer can perform its tasks; and two, its complexity and newness.

The learner's degree of motivation is also an important factor to consider. Specifically, those individuals who want to work with people and have a high regard for interpersonal relationships may not be receptive to heavy doses of the computer (Carrier, 1978). Therefore, it may be reasonable to infer that those with a human services perspective may not be totally receptive to CAI. It is alleged that CAI is both dehumanizing and impersonal. For example, Collagon suggests that student encouragement, inspiration and stimulation becomes mechanical while using machines. Collagon suggests further that CAI leaves little room for creativity on the part of the student (Collagon, 1976). However, Magidson refutes these allegations by pointing to CAI's individual treatment of each student. He also points out CAI's capacity to provide a patient, tireless and objective tutor, counselor, tester and/or evaluator. CAI even tolerates alternative answers and solutions. Therefore, it is suggested that CAI be used in as personal a manner as possible to counter the allegation that CAI is dehumanizing and impersonal (Magidson, 1977).

Design of CAI lessons should facilitate learner use. This requires user input, feedback and administrative support. If possible, lesson design features should consist of learner control options for replaying the text, reviewing the text and choosing the text's route.

Lesson designs must be adaptive and responsive to the student. The sequence and style of a lesson will also facilitate ease of learner use. A lesson must be as interactive as possible. For example: lesson menus should be provided within a program allowing for choice of content. A lesson should provide prompts that hint at the correct answers instead of responding with "No, try again." Questions should never be asked of the student unless information necessary to answer them is still on the terminal screen (Caldwell, 1980).

Learner input and feedback is also important. Learner input can be obtained by assessment of a student needs questionnaire, feedback opportunities in the lessons themselves and actively seeking student feedback once the lessons are in use (Daneliuk and Wright, 1981).

Administrative support of CAI is vital for learner use because it encourages individuals to utilize it. Without administrative support users may regard CAI unfavorably and therefore not utilize it (Spuck, 1978).

Ease of author use and system capabilities provided by certain programming languages is another important consideration for design and implementation of CAI. Authors of a CAI lesson should utilize their creative abilities within

the lesson. They should remember that creativity must manifest itself within the lessons in order to provide a learning opportunity for the student. This is true because CAI lessons are an extension of the author's own personality (Collagon, 1976, Magidson, 1977).

To summarize: learner and author use are the two important points to remember for CAI systems. Learner use includes prior knowledge of content and computer use, visual, verbal and mental abilities and personality characteristics. Recommendations for lesson design should consider learner characteristics. Author use must balance CAI system capabilities with different levels of author skill and creativity.

## Issues in Evaluation

A great deal of literature exists in the field concerning evaluation, most of which deals with the topic of efficacy; that is, whether or not CAI is effective as a teaching method over and above more traditional instructional methods. A smaller portion of the literature represents more formative kinds of evaluations; i.e., basic issues and facts for design and implementation of CAI. The distinction between these two kinds of evaluations speaks to the basic methodological question that our research group faced in the present pilot test: "Should the project group be involved in an efficacy evaluation of CAI, or should we administer a formative evaluation?" The group decided in favor of the formative evaluation, a decision not unrelated to the state of the literature. Since most written material has already dealt with efficacy, it was felt there was a greater need to provide a formative evaluation.

Efficacy questions as presented in the literature, however, cannot be ignored. In this portion of the literature review, pertinent information about both kinds of approaches must be conveyed. As indicated earlier, Sorlie and Essex assert that evaluation of CAI should be both formative and summative (Sorlie and Essex, 1979). Therefore, to provide a broadly inclusive review of the literature while omitting information about efficacy would render this report inadequate. Most certainly, it is vital to ask the question: "Is CAI an effective method of instruction?" Presumably, the decision to develop CAI must be based on, among other things, an affirmative answer to this question.

Well, is it an effective method of instruction? Several relevant articles were reviewed and some representative samples were chosen. Generally, most of the material answers the above question in the affirmative: CAI is an effective teaching tool (Thomas, 1979; Smith, 1979). David Thomas reviewed the effectiveness of CAI in secondary schools and found that it led to achievement levels equal to or higher than traditional instruction, as well as to favorable user attitudes, savings of time and, finally, comparable levels of learning retention and cost (Thomas, 1979). A five-year longitudinal study in the U.S. Navy, noted above, was also favorable, though certain cautions are given (Misselt, et al., 1980).

Other portions of the literature have suggested mixed results for CAI (Bagley and Klassen, 1979). This study of the use of CAI in Minnesota correctional facilities indicated no achievement or attitude increase that could be attributed to CAI; however, there were indications that CAI could be used

to provide repetitious drill for low ability students and that it increases motivation and problem-solving skills.

A small portion of the literature suggests the ineffectiveness of CAI. Edward Nelson presents the result of a program of individualized instruction in typing and shorthand classes. He suggests that, although CAI did reduce costs and did accommodate increased enrollments, it was not successful in terms of student achievement and faculty utilization (Nelson, 1978).

A number of other studies have indicated different effectiveness levels based on varying CAI systems, curricula and student types (Splittberger, 1979). There are some suggestions that subjects allowing "high student discretion," such as humanities, are not subjects easily taught through CAI. On the other hand, subjects of "low student discretion," such as mathematics and the hard sciences, are more applicable to CAI. There is an implication here that licensing and certification might be highly applicable for instruction in CAI, since the requirements of the law supersede much of worker discretion, professional judgment notwithstanding.

Differing results concerning effectiveness of CAI are almost certainly reflections of the particular circumstances involved in the development of each system. There are a number of complex variables necessary to constitute a quality system; and in this light, it is no surprise that some systems fail to produce the expected results. At some point, an agency should undertake a study of the effectiveness of their CAI. The results of such a study would be important feedback for possible system alteration.

The importance of utilizing formative evaluations has already been indicated. This pilot project in CAI as a training alternative for certification and licensing in child welfare is just such an evaluation, a point which indicates that the Bureau of Regulatory Services is already acutely aware of this necessity. This report can serve not only as an evaluation for the present, but also, insofar as it has defined the essential issues of CAI, it suggests a model for continuing evaluation. However, to review again each issue here would be an exercise in redundancy and would serve no useful purpose. The important point to consider is that each topic of this review is an issue that must be evaluated in some form or another.

The methods of evaluation depend, of course, on an agency's particular needs and resources. Margaret Hazen argues that evaluation of CAI should be multi-method in nature (Hazen, 1980). She argues that evaluations should employ attitude questionnaires, interviews, archive research, observation and experimental methods. Her article refers essentially to effectiveness evaluations, but does have relevance for formative approaches as well.

In a micro-computer CAI project in Canada, Daneliuk and Wright report that extensive use of discussion papers provided the essential evaluative method (Daneliuk and Wright, 1981). Project staff were required to submit discussion papers at pre-determined stages of development and implementation. Papers were submitted by many participants and covered a broad range of topics.

To summarize: the literature suggested that evaluation of CAI should be both formative and summative. Effectiveness of CAI has been evaluated by

many studies, most of which have indicated positive results. However, some literature did suggest mixed and negative results. Whether or not CAI is useful for a particular organization depends on many variables; and it can reasonably be asserted that effectiveness of a particular CAI system depends largely on the commitment of that organization to CAI. Finally, evaluations should utilize many methods and should be based on the essentials of CAI itself; the essentials which have constituted the content of this report. No evaluation of CAI can be considered adequate unless it has addressed as many of these issues as possible.

## Summary

Literature pertinent to CAI installation has been presented in this section of the report. The review yielded information which was organized into the following topics: CAI: What is it?; Issues for Planning, Research, and Development; Hardware; Software; Cost of CAI; Human Factors; and Issues in Evaluation.

The first section presented a general introduction to the use of computers in instruction. This included some basic definitions and a list of advantages and disadvantages of CAI. The section concluded with a brief history of CAI as it developed out of programmed instruction.

The second section emphasized the importance of planning for the development of CAI. CAI requires early definition of program objectives which will provide answers to a variety of questions, such as choice of hardware, software and selection and/or training of personnel. To define these objectives an agency must determine both its needs and resources.

The next portion of the literature review considered hardware. The distinction between the maxi-, mini- and micro-computer was outlined. Micro-computers offer a low cost entry level for CAI; however, at present, they have limited capacity to perform operations necessary for adequate instructional usage; but technological advances are pointing to the day when micro-computers will overcome this disadvantage.

In the next section, software was considered. Various types of courseware design were presented as suggested by the literature. The use of computer language for programming was reviewed. Authoring languages provide a possible solution to the content vs. programmer specialist issue. Finally, an outline of the courseware creation process was presented.

The cost of CAI was then considered. This issue was extremely difficult to address and the literature was weak in providing adequate guidance for cost estimation. Software costs have been continually rising over the past thirty years and by 1985 it is predicted to reach 90 percent of the total cost for CAI.

Literature resources were also identified which suggested a variety of psychological considerations affecting the development of CAI. User apprehension of the hardware is a major concern to be confronted by developers of CAI. Sincere use of user feedback can be employed to combat this apprehension. Additionally, administrative support must be solicited for CAI; otherwise

equipment and programs will go unused.

In the final section, the team reviewed literature which suggested that a variety of evaluative methods could and should be employed to assess CAI. Both a formative and summative approach was recommended.

IV

# FINDINGS: REACTIONS FROM THE FIELD

## Introduction

In addition to an extensive review of the literature, the project also provided for the administration of CAI lessons to licensing and certification specialists in the field. As mentioned previously, the research staff designed and implemented its own evaluation instrument for the field. The questionnaire elicited demographic information as well as attitudinal information concerning the CAI experience (see Appendix B). Twenty-seven different child placing agencies were visited and twenty-nine questionnaires were obtained from licensing specialists. The purpose of this section of the report is to present the results from the field experience.

For clarity, the discussion of the results will be divided into three parts: one, a demographic profile of the sample; two, the distribution of levels of agreement on attitudinal items from the field evaluations; and three, a discussion of relationships between selected items on the field questionnaires.

## Profile of the Participants

### Lesson(s) Taken

Table A in the Appendix provides the distribution of responses from the sample.

Generally all the licensing specialists completed any one of the lessons within thirty to fifty minutes. On the average, each lesson was taken in forty to forty-five minutes. Seventy-nine (79.3) percent of all the participants took two or more lessons. Thirty-one percent of the sample took "COMPLA" and "PSFOIA." Twenty-seven (27.6) percent of the participants completed all three lessons. At the onset nearly all the participants were hesitant about taking the lessons. However, within a few minutes their anxiety level had significantly decreased. In fact, many of the participants felt comfortable taking more than one lesson as indicated by their choices of a number of options.

### Experience in Licensing and Certification

In terms of experience in licensing and certification, 51.7 percent of the sample had three or more years of experience, 20.7 percent six months to one year, 10.3 percent two years, 10.3 percent one year and 6.9 percent had less than six months of experience.

### Percent of Job Responsibilities

The median percent of job responsibilities devoted to licensing and certification for all the participants was fifth percent. More precisely,

31.0 percent of the sample devoted 76-100 percent of their job responsibilities to licensing and certification, 31.0 percent devoted 1-25 percent, 20.7 percent devoted 26-50 percent, 10.3 percent devoted 51-75 percent and 6.9 percent of the sample did not respond to this item.

### Previous Training

In terms of previous training in licensing and certification 34.4 percent of the participants had between 1-10 hours of training, 27.6 percent had between 11-15 hours and 24.1 percent had 20 or more hours of training. The median amount of previous training for all the participants was in the range of 11-15 hours. Forty-five percent of the sample indicated the source of their training as outside the office, 17.0 percent inside and 31.0 percent indicated both inside and outside.

### Prior Experience with a Computer

Sixty-nine percent of the sample had no prior experience working with a computer and thirty-one percent had some exposure. Of those nine participants who indicated prior experience, they specified experience in university coursework, data processing work and, in two cases, actual experience with a micro-computer.

### Sex of the Participants

Seventy-six percent of the sample was female and twenty-four percent was male.

## Participants' Attitudes

### Distribution of Responses

Table B in the Appendix provides mean (average per item) scores, variances and standard deviation for attitudinal items 8-32. As mentioned in the Methodology section, the participants indicated their attitudinal responses on a five-point Likert-type scale; therefore, possible mean scores range from one to five, inclusive.

Of particular interest are the mean scores for items 8-32. Twenty-one of the twenty-five items have a mean score of 3.0 and above; four items have a mean score clustering around 1.0. That is, on twenty-one of the items, the participants tended to agree, while on the remaining items they disagreed. These mean scores indicated the level of convergence (agreement) among all the participants based on their reactions to questionnaire items. In general, the level of convergence on the twenty-five items was very high.

### Questionnaire's Demographic and Attitudinal Ratings

As noted above, the field questionnaire elicited responses in which ratings were made on a five-point Likert-type scale. For analysis, shortened code words (descriptors) were utilized and are provided here as a means for subsequent discussion of the attitudinal ratings.

TABLE I

EVALUATION'S DEMOGRAPHIC AND ATTITUDINAL ITEMS

| Item Number | Description | Brief Item Description |
|---|---|---|
| 1 | LESSO | Lesson selected |
| 2 | EXPER | Experience in licensing and certification |
| 3 | PERCE | Percent of job on licensing and certification |
| 4 | TRAIN | Amount of previous training |
| 5 | SOURC | Source of training |
| 6 | PRIOR | Prior experience with computers |
| 7 | SEX | Sex of respondent |
| 8 | APPRE | Apprehensive about using computers |
| 9 | POSIT | Generally positive re computers for training |
| 10 | CLEAR | Performance expectations were clear |
| 11 | SUFFIC | Sufficient knowledge in licensing |
| 12 | KNOWL | Lessons increased knowledge base |
| 13 | FORMA | Format or layout was attractive |
| 14 | STRUC | Structure of sequence was helpful |
| 15 | PACE | Comfortable pace for lessons |
| 16 | FEED | Immediate feedback was helpful |
| 17 | ADDRE | Lessons addressed important aspects |
| 18 | TERM | Terminal was easy to use |
| 19 | PRINT | Printout was helpful reference |
| 20 | FUTUR | Printout helpful resource in future |
| 21 | QUEST | Format--text followed by questions was effective |
| 22 | TIME | Amount of time too long |
| 23 | CONTR | Generally felt in control |
| 24 | END | Comment section at end |
| 25 | STAFF | Presence of staff was uncomfortable |
| 26 | SUPPO | Project staff was supportive |
| 27 | WORK | CAI is a workable method |
| 28 | SUPPL | CAI is a possible supplement |
| 29 | ORIEN | CAI as a possible orientation |
| 30 | USEFU | CALCAL was a useful learning experience |
| 31 | IMPER | CALCAL too impersonal |
| 32 | WOULD | Would use if available |

To help the reader gain a perspective over all the responses the response categories for each item were collapsed. Those participants who scored an item "1" or "2" have been grouped into one category, "disagree." Similarly, those participants who scored an item "4" or "5" have been combined into another category, "agree." Those participants who indicated a "3" for "not sure" have not been grouped. Combining similar ratings made the organization and management of the data more convenient and served as a conservative method for the analysis. All the ratings are referred to in this manner for the remainder of the discussion. Table C in the Appendix provides the results of grouping the responses for attitudinal items (8-32).

In Table C one can see that Items 9, 10, 11, 16, 18, 21, 23, 28, 30 and 32 contain no disagreements. In other words, on all these items none of the participants disagreed with any of the statements. A few of those statements were: Item 9, "Generally speaking, I feel positive about the use of computers for staff development and training," Item 23, "I generally felt in control of my progress as I moved through the lessons" and, finally, Item 32, "I would use this approach to training if it was readily available" (see Appendix B).

Topical Areas

As mentioned previously in the discussion of project methodology, the questionnaire was designed to elicit responses on four topical areas. Those areas were: one, a demographic profile of the sample; two, lesson content; three, questions related to lesson administration; and four, feelings concerning the CAI experience. Items were then selected directly pertaining to three of these four areas, namely content, administration and experience. Items 11, 12, 14 and 17 were placed into the content category, Items 16, 18, 19, 21, 23 and 26 into administration and Items 27, 28, 29, 30, 31 and 32 into the experience category. By carefully placing particular items on the questionnaire into categories, three constructs were developed for analysis.

By grouping appropriate items into theoretical constructs, one can more easily see patterns and interrelationships among and between items. In responding to content items, 76.5 percent of the participants felt they had sufficient prior knowledge to successfully complete the lessons. However, 75.9 percent of the sample indicated that their knowledge base had been improved by taking the lessons. Therefore, it was inferred that the content of the lessons made a significant contribution to the users' knowledge of licensing and certification. Furthermore, 86.2 percent of the participants indicated the lesson(s) satisfactorily addressed important aspects of licensing.

The participants were very much in agreement on the category of items dealing with administration of the lessons. Specifically, on four of the six items pertaining to administration there were no disagreements recorded among any of the participants. Of the remaining two items, only one participant on each item disagreed. Generally, the following results were found: 96.6 percent of the sample agreed that the portable hard-copy terminal was easy to use; 86.2 percent of the sample stated the lesson format, i.e., text followed by questions, was an effective way of learning; and 82.7 percent of the sample indicated that the project staff was an important source of information and support for this experience.

In response to items dealing with the CAI experience, the participants reacted favorable. One hundred percent of the sample agreed that CAI could be used as a supplement to ongoing training. Seventy-five (75.8) percent of the participants disagreed with the statement, "I found my experience with CALCAL too impersonal." Finally, 86.2 percent of the entire sample indicated the CALCAL program provided them with a useful learning experience.

In conclusion, when the research staff compared the means and variances between these three areas, little difference was found, i.e., the participants felt similarly about each of the three topical areas. The results clearly suggest that the participants found the CAI experience enjoyable, pertinent to licensing and certification and something they would like to use if it was readily available.

## Participant Characteristics and Attitudinal Responses

In this section of the report all characteristics of the participants will be compared with their attitudinal rating on the questionnaire items. Tables D-J in the Appendix graphically present each of these comparisons.

As stated, 79.3 percent of the sample elected to take two or more lessons. The largest group of participants took all three lessons. When comparing selected attitudinal items with lessons taken, it is important to note that all twenty-nine participants unanimously agreed that CAI could be used as a supplement to on-going training. In all but one lesson option, each participant felt they had sufficient prior knowledge in the area of licensing to successfully complete the lessons. One participant who took "PSFOIA" and "CLASS" was "unsure" whether he/she had sufficient prior knowledge to successfully complete the lessons. The two largest groups of participants in terms of lessons taken, those who took "COMPLA" and "PSFOIA" and those who took all three lessons, consistently agreed on nearly all the selected attitudinal items. Generally, it was inferred from these comparisons that the lessons were designed with a generic purpose, i.e., to inform both those licensing specialists who have had vast experience in the field and those who have had relatively little experience.

A closer examination of the amount of experience in licensing and certification compared with selected attitudinal items revealed similar results. Those participants with three or more years of experience were more apprehensive about the use of computers than those with six months to one year of experience. A possible explanation for this phenomenon may simply be that more experienced licensing workers have not been introduced to computers, or perhaps younger workers may have been exposed to computers at some point during their university coursework. Regardless of the amount of experience in licensing and certification, the participants in our study were generally in agreement on selected attitudinal items.

If one compares the percent of job responsibilities devoted to licensing and certification with selected attitudinal items, the largest groups of participants, those who devoted 1-25 percent and 76-100 percent of their time

to licensing, indicated similar ratings on the questionnaire. For example, 83.3 percent of the participants who devoted 26-50 percent of their time to certification said CAI was a workable and practical way to teach some aspects of licensing. In the same light, 77.8 percent of those workers who spent 76-100 percent of their time performing licensing related tasks agreed that CAI was a workable way to teach some aspects of licensing. Therefore, it seems reasonable to conclude that, despite the dispersion in the amount of time devoted to licensing, all of the specialists felt that CAI could be a viable approach to educating new or experienced staff.

When investigating the comparison between hours of previous training, the participants showed markedly different responses to particular attitudinal items. The largest group of participants, for instance, had 11-15 hours of previous training. That group unanimously agreed that the lesson(s) satisfactorily addressed important aspects of licensing. On the other hand, only 50.0 percent of the participants with 1-5 hours of previous training believed the lesson(s) addressed important aspects of licensing. Similarly, 100 percent of the group with 21 or more hours of previous training felt positive about the use of computers for staff development and training. Yet of the participants with 1-5 hours of previous training, only 60.0 percent felt positive about the use of computers. The results seem to consistently indicate that those participants with greater previous experience in licensing are generally more receptive to the use of computers for staff training. The majority of the comparisons between hours of previous training and selected attitudinal items clearly showed that CAI was viewed as a potentially useful method of instruction. And, when the source of a participant's training was examined, no significant disparities were discovered on selected attitudinal ratings. Hence, despite the differences in the number of participants within each category, their responses closely resembled one another in terms of agreement.

A comparative examination of prior experience with a computer and selected attitudinal items raised several interesting observations. Eight-nine (88.9) percent of the participants who said they had prior experience with a computer disagreed with the statement, "I am apprehensive about using computers." However 60.0 percent of the participants without prior experience indicated they were not apprehensive. One would expect that someone with no prior experience with a computer would be more apprehensive. Yet 60.0 percent still constitutes a large number who were not apprehensive despite having no prior computer knowledge. As stated previously, nearly 80.0 percent of all the participants did elect to take two or more lessons.

Finally, a comparison of the sex of the participants yielded unique differences in relation to selected items. One of those differences was that 63.6 percent of female participants disagreed that they were apprehensive about the use of computers and 85.7 percent of male respondents stated they were not apprehensive. Generally, the female participants in our study were slightly more apprehensive about the use of computers. Another observation was that 42.8 percent of the males disagreed that the CALCAL experience was too impersonal, while 86.3 percent of females disagreed.

In summary, there were few differences between groups of participants about issues related to CAI. On the aggregate, our sample viewed CAI as

overwhelmingly positive and in most cases indicated they would use CAI if it was readily available.

## Attitudinal Responses Compared

This section of the report is a discussion of the comparison between selected attitudinal items from the field questionnaire. It is intended to further illustrate the participants' favorable response to the CAI experience.

Several questionnaire items were directly related to issues concerning administration of the lessons. Of the twenty-five participants who indicated the lesson(s) proceeded at a comfortable pace, twenty-three felt in control of their progress. Of the twenty-one participants who stated they had sufficient prior knoweldge in certification and licensing to successfully complete the lesson(s), twenty participants agreed the lesson(s) increased their knowledge base in the content area. Interestingly, only three participants disagreed that their knowledge base in licensing and certification was increased.

Another important aspect of the CAI experience was the issue of apprehension. As previously mentioned, approximately twenty-four percent of the sample indicated they were apprehensive. However, of the seven participants who said they felt apprehensive, six agreed the project staff was an important source of information and support for the experience. Of those participants who were apprehensive, five did state that computers were a positive way to teach some aspects of licensing. Twenty licensing specialists indicated they were not apprehensive about the use of computers; sixteen of those participants agreed that computers were a positive way to teach some aspects of licensing. Therefore, our results seem to indicate that, whether there was apprehension concerning the use of computers or not, the participants' reaction to their use was nearly the same.

In summary, the participants' positive reactions to essentially all aspects of CAI were impressive. This would lead one to conclude that the licensing specialists were very receptive to the concept of computer-assisted instruction. The section which follows was reserved for the participants to express ideas for application of CAI in licensing and certification along with possible areas of improvement.

## Additional Comments

Approximately 23 out of 29 licensing specialists responded to the open-ended question: "How do you see this approach being used in the future?" The participants generated a number of ideas for possible applications of CAI, some of which are as follows: one, if CAI were developed, the amount of travel time and cost of attending statewide in-service training sessions would significantly decrease; two, the CAI lessons could be an effective training device if used in conjunction with the licensing and certification technical assistance manual; three, if CAI lessons were readily available, new or experienced workers could review the lessons at their leisure. To continue, one participant stated that CAI could be installed as an evaluation tool for determining the competency of new or potential licensing workers. Two persons

indicated that a CAI system would be a practical multi-agency sharing device; i.e., many agencies within a geographic area could share terminals or micro-computers, thereby eliminating the installation of equipment at several different sites.

Although a major concern of licensing specialists was that CAI should not replace the one-to-one dialogue between workers and consultants, the participants generally reacted positively to the CAI lessons as a resource for both new and experienced licensing staff.

Nearly fifty percent of the sample provided comments to the open-ended question: "How could the CALCAL experience be improved?" The response to this question was primarily directed at two areas. First, licensing specialists indicated that they would have preferred a more interactive experience with the terminal. They thought this could be achieved through graphic illustrations and audio communication as aids to the learning experience. They also stated that the presence of a licensing consultant would alleviate much of the anxiety associated with computer usage. Incidentally, one person suggested that a pre-lesson on terminal operation would have also been beneficial.

The second area of response dealt directly with the lessons' content and format. As expected, some of the licensing specialists found ambiguity in a few of the lesson texts and questions. The workers also recommended that a number of hypothetical situations or case studies be included within the lesson text to stimulate greater interest in the lessons. Finally, one participant suggested that a summary be included at the end of each lesson so that further integration of the information could be achieved.

## Summary

The field findings indicated that the twenty-nine participants found the CALCAL experience to be both acceptable and informative.

Despite some initial hesitation on the part of a number of the participants, 78 percent took two or more of the lessons. Satisfaction with the content of the lessons was consistently high over all of the lessons.

When other demographic categories were controlled (i.e., experience in licensing and certification, percent of job responsibilities devoted to licensing and certification, hours of training and source of that training) it was observed that the ratings on the attitudinal items continued to be consistently high. It was also found that 40 percent of those attitudinal items were in the 90-100 percent range of agreement, while over 60 percent were in the 80-100 percent range of agreement.

The sample of participants registered no disagreement on the following attitudinal items: Item 9, positive about the use of computers for staff training and development; Item 10, performance expectations were clear; Item 18, hard-copy terminal was easy to use; Item 21, lesson format was an effective way to teach licensing and certification; Item 23, felt in control of progress; Item 28, CAI could be used as a supplement to ongoing training; Item 30, CALCAL was a useful learning experience; and Item 32, would use this approach if readily available.

In spite of the fact that 70 percent of the sample had no prior experience with a computer, the use of computers for training purposes was a highly acceptable idea among the participants. Attitudinal responses were as high among those with no prior experience as among those with prior computer experience.

Again, although nearly 70 percent had no computer experience, only 24 percent of the sample indicated feelings of apprehension regarding computer usage. Interestingly, the CAI experience was as highly accepted among those who were apprehensive as it was among those who were not. Among those with no computer experience, none felt that the CALCAL experience was too impersonal.

Probably the most notable finding was the complete agreement of all participants on item 28, "CAI could be used as a supplement to ongoing training." The total agreement was consistent along all demographic categories, as indicated in the demographic-attitudinal comparisons.

Agreement in the three topical areas (content, administrative, and experiential) was consistently high across all areas.

Despite the fact that over 96 percent of the sample felt they had sufficient prior knowledge to complete the lessons, 76 percent agreed that the lessons increased their knowledge base. At the same time, 86 percent agreed that the lessons addressed important aspects of licensing and certification (while controlling for years of experience and hours of training in licensing and certification).

The hard-copy terminal was well accepted (96.5 percent), with the same number of participants also agreeing that the printout was a useful reference tool during the lesson. The tutorial format of the lessons also was well received (86.2 percent agreement).

The experiential factors were also quite positive, despite the lack of prior computer usage. The participants overwhelmingly agreed that CALCAL was a useful learning experience and that they felt generally in control of the learning process.

Overall, the CAI field experience was very well received. Regardless of the amount of computer experience or the amount of apprehension about computers, there was a high degree of support for the use of computers in staff training and development. In addition, the participants agreed that CAI was a workable and practical method for teaching licensing and certification and was a method which they would use if readily available.

V

# DISCUSSION AND IMPLICATIONS

The literature and field findings both indicated that computer-assisted instruction (CAI) is amenable to licensing and regulation. Computer-assisted instruction, a program which provides for direct interaction between the student and the computer, employs a systems approach to instruction. This approach includes specific and measurable instructional objectives (Schoen, 1977). The literature findings suggest that content allowing for "narrow user discretion" is more applicable to CAI than is content allowing for "broad user discretion." It would seem that licensing and regulation, in which requirements of statutes and rules limit much user discretion, would be highly applicable for CAI. In fact, over three-fourths of the sample said the CAI lessons increased their knowledge base in the area of licensing. Over three-fourths of the sample also said that CAI is a workable and practical way to teach some aspects of licensing and certification. Seventeen percent of the sample said they were not sure, but no one disagreed with the statement that CAI is a workable and practical way to teach some aspects of licensing and certification.

In general, taking the CAI lessons was a positive experience for the licensing specialists. Regardless of the amount of experience, the amount of training, or the source of training, over three-fourths of the sample said they felt positive about the use of computers for staff development and training. One-fourth of the sample said they were not sure, but no one indicated they were not positive regarding its use.

Three lessons were offered to each licensing specialist. Each had a choice of taking one, two or all three lessons. When given this choice, 79 percent took at least two of the lessons and 27 percent took all three, providing additional evidence that taking the CAI lessons was a positive experience for them. However, it must be added that the participating agencies were pre-selected by their area consultants as potentially interested and probably cooperative. This may have resulted in a somewhat biased sample. The degree of acceptance may be less if all agencies were required to use CAI for training.

According to the literature findings, the need for planning and research in the development of a CAI system is greater than that required by non-computerized projects. The need for planning and research cannot be stressed enough. A six-month, funded, start-up phase for planning and research is recommended. Furthermore, it is very important that operational goals be defined during the early part of this phase (Sorlie & Essex, 1979). Dimas (1978) says an organization must define and clarify the role it wishes CAI to play in an educational program. The decision should be made at this time whether to use CAI as a supplement to ongoing training or as the only means of training. The field findings indicated that 100 percent of the sample felt CAI could be used as a supplement to ongoing training. However, this item is difficult to interpret because of its ambiguity. It could be interpreted that CAI should be used as supplemental training, or that CAI could be used as supplemental to, but not in place of, ongoing training. In support of the former interpretation, over three-fourths of the sample felt positive about the use of computers for staff development and training.

The literature findings indicated that input from user groups is very important during the six-month start-up phase. This input generates important design information and also lays the groudwork for successful implementation by giving user groups a sense of ownership in the CAI system (Sorlie & Essex, 1979).

When considering investment in a CAI system, the organization must decide if the equipment can and will be used for needs beyond training, i.e., word processing and record management. This decision is administrative in nature, not technological. The technology is available for a system which meets more than one need. The decision, then, evolves around the priority of training relative to the other needs and demands to be placed on the equipment or the system.

The use of CAI for training would be of great help to new staff in an agency. Rather than having to wait for the next training session, the material would be available for new staff in a timely manner. Over three-fourths of the sample felt that CAI could be used as an orientation device for new licensing workers. Several licensing specialists mentioned that new staff may work several months before a training session is held. If CAI were available in the office, some training could be done immediately.

A disadvantage of using CAI is that licensing and regulation is a technical and legalistic field. The material generates many questions. If CAI is used, particularly with a new worker, the worker may need a consultant present or available to answer questions about content or equipment. The field findings indicated that 83 percent of the sample felt that the presence of the project staff was an important source of information and support while taking the lessons. While it has been mentioned that the licensing specialists' attitudes about the use of computers for training are positive, it cannot be presumed that the same positive results, without staff presence, would be expressed. Nevertheless, the involvement of a consultant or a work supervisor in some fashion could enhance the learning experience as well as develop work relationships in a learning oriented environment.

The resources needed to meet program objectives must be identified and provided during the six-month start-up phase (Sorlie & Essex, 1979). An organization must take into account what resources it already has available and what are needed to meet its goals. According to the literature findings, there are three main types of hardware available. These are large, main-frame computers, mini-computers and micro-, or personal, computers. Each has its advantages and disadvantages. The large, main-frame computers have many languages available for use, a large memory and the capacity for many terminals for time-sharing. A disadvantage of main-frame computers is that, during system down time, CAI is not available. This was observed in the field as one licensing specialist was unable to take the lessons and several others had waits of up to two hours during unplanned system down time. The mini-computer has limited time-sharing capacity for fewer terminals and a relatively small memory, although these limitations are diminishing. The micro-, or personal, computer, has no time-sharing, no external terminals and a much smaller memory capacity. However, technology will soon allow for much greater memory in micro-computers. Another disadvantage of the micro-computer is the lack of authoring languages available. An authoring language

is a high level language which makes programming CAI lessons easier for the author. However, authoring languages are now becoming available for micro-computers as well as main-frame computers. Thus, the differences among the three types of hardware are diminishing. The literature suggests and our experience indicates that, with the present state of the art, one viable alternative for CAI is a micro-computer interfaced with a main-frame computer (Crease, 1977). The main-frame's large storage capacity is necessary, but a micro-computer would work just as well in taking the lessons. A CAI disc could be sent to the user to use on his/her own micro-computer, thus avoiding the time-sharing problems of the large computer, but retaining the memory capacity of the main-frame computer. A second viable alternative, and one which avoids the logistical nightmare of retrieving and updating outdated diskettes, is the mini-computer located at strategic "learning center" sites.

The choice of hardware may also depend on what the organization already has available (i.e., an existing administrative computer) and what other uses (e.g., word processing, record management) the computer will serve. A major factor, of course, will be the availability of resources for purchase.

In this project a terminal with hard copy printout was used. According to Bork (1979), the present technological trend is away from paper printout units to video display units. A disadvantage of video display units is that they scroll, making the text unavailable for use as a reference while answering questions. This is an important consideration as 97 percent of the sample said the hard copy printout was a useful reference during the lessons. The printout appears to have limited usefulness, however, as only 59 percent of the sample said it would be useful as a reference in the future. It is impossible to compare reactions to the hard copy printout units and video display units, as only hard copy printouts were used in this project. Since the trend in technology is toward video display units, perhaps one with reverse scrolling features would meet the workers' needs for reference during the lessons.

Software, or courseware, needs must also be identified and provided during the six-month start-up phase as well as during an ongoing CAI project. The commitment to courseware is essentially a commitment to personnel. Existing staff must be trained and/or new staff must be hired to develop courseware, since CAI programs for special needs are not available off the shelf. Courseware costs make up 75 percent of the cost of a CAI program, mainly due to personnel costs, and these relative costs are projected to increase. Both content and programming specialists are needed to develop a CAI program. The ideal arrangement for preparation of materials, according to the literature findings, is a staff consisting of content specialists backed up by support personnel. This team would include content matter specialists, instructional programmers and educational technologists with part-time support from audio-visual and computer specialists. A staff is needed for CAI development as no one person has all the necessary skills to accomplish it alone (Leiblum, 1979). However, the development of high level authoring languages has made programming CAI lessons much easier. Not as much programming knowledge is needed, as was the case when only lower level languages were available (Rudnick, 1979).

The literature findings suggested that the author of CAI courseware should

become aware of the "systems" approach in designing instructional materials. This approach includes, in order, identification of educational needs, formation of behavioral objectives, selection of strategy and sequencing, selection of media, preparation of instruction, evaluation of learning objectives and materials and reworking of defective parts (Ingle, 1979). According to the literature findings, there are seven approaches in providing a CAI program. These are drill and practice, tutorial, problem solving, gaming, simulation, inquiry and dialogue (Ingle, 1976). The literature suggested that the tutorial and simulation approaches are most compatible with the content of licensing and certification and the field findings support that view. This project primarily used the tutorial appraoch. Eighty-six percent of the sample said the lesson format was an effective way of learning. However, many licensing specialists expressed a desire for the simulation approach in which hypothetical situations are provided to which they could respond.

The literature findings also suggested that courseware design must relate to necessary facts and concepts and also be presented in a useful and creative manner (Daneliuk & Wright, 1981). In the field findings, 86 percent of the sample said the lesson format provided an effective way of learning, 76 percent said the lessons increased their knowledge base in the area of licensing, 90 percent said the structure helped them to comprehend the material and 72 percent said the format, or layout, was attractive to them. This would appear to deomonstrate that the lessons related to necessary facts and concepts about licensing and that the lessons were presented in a useful and creative manner.

The licensing specialists may have been so receptive to CAI because it is a novel approach. After using CAI over a long period of time, the novelty may wear off. Novelty is also a concern when considering workers who may be computer-sophisticated. Courseware designers will have to be continually working toward creative ways of presenting CAI to avoid boredom.

Staff time for the development of CAI lessons is another consideration. The literature findings indicated it takes from one hundred to three hundred hours to develop one CAI lesson. For this project, the author and support personnel spent approximately eighty hours to develop each lesson, i.e., a total of eighty person hours per lesson. Once developed, the courseware must be updated from time to time. This is certainly true in licensing in terms of changes in statutes, rules or regulations.

Thus, as can be seen, the commitment to courseware is a commitment to personnel. Courseware is the largest commitment made in the development of a CAI system.

Is CAI worth the financial investment? According to the literature findings, cost is a difficult topic to address (Bozeman, 1979). There is little guidance in the literature. Included in cost estimations are hardware, courseware, telecommunications, logistics, service and service contracts, personnel and research and development. The cost of CAI depends on the organization's operational goals and the role that CAI is expected to play. The present resources of the organization will also have a bearing on cost, i.e., use of an existing administrative computer, leased telephone lines, etc. If the equipment can and will be used for other purposes, (e.g., word processing

or record management), some costs can be distributed.

The literature findings indicated that effectiveness of instruction is the prime consideration when deciding if CAI is worth the financial investment (Patrick & Stammers, 1977). This calls for a value judgment on the part of the organization contemplating the use of CAI. According to Kearsley (1977a), cost estimates should be balanced against alternative methods of instruction or training. The use of CAI for training in licensing and regulation may reduce costs in terms of Bureau and placement agency staff time and travel. As previously stated, the cost of courseware makes up 75 percent of the cost of a CAI system and will probably continue to rise relative to other costs of a CAI system. Computer-assisted instruction for special needs is not available off the shelf and the costs of manpower to produce software are high.

The literature findings suggested that a human service agency contemplating the use of CAI should also consider human factors. According to Carrier (1978), the learner's prior knowledge of the computer, the learner's knowledge of content and proper support and information sources for the learner need to be taken into accout. Ninety-seven percent of the sample felt they had sufficient prior knowledge in licensing and certification to successfully complete the lessons. However, less than one-third of the sample had prior experience in working with a computer. Several licensing specialists mentioned that they would have liked more exposure to the computer prior to taking the lessons in order to become more familiear with the equipment. The findings indicated the sample did have sufficient prior knowledge of the content, fulfilling that condition mentioned by Carrier (1978). Since over three-fourths of the sample felt that the CAI lessons increased their knowledge base in the area of licensing and certification, it would appear that a proper balance between prior knowledge and new material was achieved. As to proper support, 83 percent said the project staff was an important source of information and support. Concern has been voiced about the effects of the machine on human relationships. With proper support and information services available, followed by debriefing, this may not be a problem.

Learner apprehension about CAI is another consideration, according to the literature findings. Carrier (1978) says the learner will be less apprehensive if he/she has had prior experience with a computer. The field findings did not support this view. Two-thirds of the sample had no prior experience with computers, yet only one-fourth of the sample said they were apprehensive about using computers. However, this sample of licensing specialists were not asked about their apprehensiveness until after they had taken the lessons. The successful completion of the lessons may or may not have diminished their apprehension. In addition, 83 percent of the sample said staff presence was an important source of information and support. The presence of staff also may or may not have decreased their apprehension. Still, over 70 percent of those who said they were apprehensive about using computers said they felt positive about the use of computers for staff development and training. That is, only slightly fewer participants said they felt positive about computer usage in the face of apprehensiveness. The literature findings also suggest that apprehension may be due to the rapidity of the pace of the lessons. Since 90 percent of the sample felt the lessons proceeded at a comfortable pace and 93 percent felt in control of their progress through the lessons, this too may

have diminished apprehension. Again, it is difficult to generalize since the participants were not asked about being apprehensive until after they had successfully completed the lessons.

User motivation was another important topic dealt with in the literature review and the field experience. The literature findings suggested that human service workers, who tend to place high value on interpersonal relationships, would not be receptive to CAI and to computer usage in general (Carrier, 1978). The field findings did not support this hypothesis. This sample of licensing specialists, who are human service workers, was highly receptive to CAI. Seventy-six percent of the sample felt positive about the use of CAI for staff development and training. Eighty-six percent felt the lessons provided a useful learning experience for them, seventy-nine percent said they would use this approach to training if it were available and one hundred percent of them said CAI could be used as a supplement to ongoing training.

It has also been alleged that CAI is dehumanizing and impersonal (Collagon, 1976). The field findings did not support this hypothesis. In addition to the receptiveness to CAI noted above, over three-fourths of the sample disagreed with the statement that these CAI lessons were impersonal. Computer-assisted instruction provides for anticipated responses and for an interactive relationship with the learner, thus providing a more personal and efficient way of learning than the reading of an instructional memo. In addition, the presence of the project staff may have personalized the experience for these licensing specialists. It will be remembered that a high percentage of the sample felt the presence of the staff was an important source of information and support. As this method of delivery (i.e., with attendant staff) will be unlikely and expensive in the future, other alternatives will have to be found. Supervisors and/or peer groups within the agency providing support and information is a possibility. In addition to giving supervisors more involvement with training than they have at the present time, supervisors and peers would have an investment in the training program and process. Also, both supervisors and peers would be available for debriefing following the CAI training. This presence of other staff capable of being helpful could also assist in "humanizing" the CAI process.

The literature findings indicated that CAI could facilitate user experience by allowing opportunity for user input and feedback, allowing user choice of lesson(s), allowing the user the opportunity to control the course and progress of the text and providing the user the opportunity for general control over the CAI experience. The field findings indicated that the licensing specialists felt these lessons incorporated the above suggestions. The participants were offered a choice of lessons and 93 percent of the sample said they felt in control of their progress as they moved through the lessons. Only 62 percent of the sample felt the user comment section at the end of the lessons offered an adequate opportunity for feedback. As previously mentioned, the presence of other staff for debriefing following the lessons may be a better means of feedback.

The literature findings stressed the fact that administrative commitment and support are essential to a CAI system. Computer-assisted instruction, no matter what hardware or courseware is used, will probably not be well received without this administrative commitment and support.

According to the literature findings, evaluation of the CAI project must be provided for from the very beginning of the start-up phase. This evaluation must be both ongoing (formative) and end product directed (summative). The evaluation should cover all aspects of CAI development, from costs to adequacy of lesson content (Sorlie & Essex, 1979). This project provided a formative evaluation of CAI. However, if an organization is considering development of a CAI system, summative evaluation must not be ignored.

The literature findings indicated that the majority of the studies are positive regarding the effectiveness of CAI as an instructional method. A summative evaluation can be conducted with users as a group, or individually. With either method, the organization would be able to monitor whether program goals were being met. Thus, not only would the workers receive training, but the organization would be able to assess the results of that training. Evaluating workers individually would allow for individual deficiencies to be corrected. However, apprehensiveness may increase for the worker with the knowledge that he/she is being evaluated. Less than one-third of the sample indicated that they were apprehensive about computers. However, it should be noted that project staff stressed to each worker that assessment of individual performance was not the purpose of the project.

In summary, the literature findings and the field findings both indicated that CAI is amenable to licensing and regulation. The workers' positive responses to CAI indicated that CAI may well indeed be a workable, practical way to teach some aspects of licensing and certification. Cost must be a consideration in the development of a CAI system. However, cost estimates can only be made on the basis of the organization's goals, resources and needs. There are conflicting points of view about the priority of training needs during periods of cutbacks. However, the need for quality staff training is increasing while the resources necessary to provide this training are shrinking. Computer-assisted instruction may be a way of meeting these training needs in the face of dwindling resources.

Further study needs to be done in several areas. First, there is a need for a better evaluative questionnaire for field studies. Several items were difficult to interpret because of their ambiguity. Second, a pre-orientation to the equipment may be of benefit to the workers in alleviating unnecessary anxiety regarding CAI. Third, there is a need to experiment with lesson formats. The simulation approach, i.e., hypothetical situations, could be tried, as many workers expressed an interest in that type of instruction. Fourth, there is a need to assess the importance of the presence of project staff on the workers' attitudes about CAI, as in the future it will be an unlikely and expensive method of delivery to have staff present. An experimental suggestion for assessing this area would be to have two groups use CAI, one group with a consultant available by telephone to answer questions on content and mechanics, and another group with no consultant available. Another possibility would be to have supervisors and/or peers available to answer these questions for a group using CAI. Fifth, there is a need to offer CAI in agencies across a wider geographical area of the state to see if the same positive attitudes are obtained. Finally, before deciding to implement CAI in training, effectiveness studies need to be conducted.

## ABSTRACT

### "Computer-Assisted Instruction as a Training Methodology for Child Placement Licensing Staff"

The purpose of this project was to conduct a formative evaluation of computer-assisted instruction (CAI) for training of child placing agency foster home certification and licensing staff. The project was undertaken as a joint effort between the Western Michigan University School of Social Work and the Bureau of Regulatory Services of the Michigan Department of Social Services, the state agency responsible for licensing and regulating non-medical out-of-home care facilities for adults and children. The Bureau of Regulatory Services has responsibility to provide ongoing staff development activities for child placement agency staff.

In preparation for the project reported here, three separate CAI lessons, together called CALCAL, were created, each focusing on aspects of licensing and certification for child welfare placement agency staff. The first (COMPLA) dealt with licensing and complaint investigations; the second (PSFOIA) with coordinating licensing investigations, protective services and the Michigan Freedom of Information Act; the third (CLASS) with a discussion of a paper by Norris Class concerning the relationship between social work and regulatory administration.

The project's data were obtained from two sources. The first was a review and analysis of CAI literature. The second was the field administration of the CAI lessons, followed by an evaluative questionnaire to twenty-nine workers from pre-selected child placement agencies in Southwest and South-central Michigan.

The literature and field findings support the proposition that CAI is amenable to licensing and regulation. The literature suggests that content allowing for "narrow user discretion" is more applicable to CAI than is content for "broad user discretion." It would seem that licensing and regulation, in which requirements of statutes and rules limit much user discretion, would be highly applicable for CAI. In fact, over three-fourths of the sample said the CAI lessons increased their knowledge base in the area of licensing and certification and that CAI is a workable and practical way to teach some aspects of licensing and certification.

Attitudes toward CAI in the field test were very positive. Regardless of the amount of experience, the amount of training or the source of training, over three-fourths of the sample felt positive about the use of computers for staff training and development.

Planning and research are necessary to the development of a CAI system. During a six-month, funded, start-up phase, operational goals must be defined and resources identified and provided. According to the findings, there are three main types of hardware available. It was suggested that one effective system for CAI is a micro-computer interfaced with a large, main-frame computer. Another alternative is mini-computers located at strategic

learning center sites. Existing staff must be trained and/or new staff hired to develop courseware for CAI as it is not generally available off the shelf. The commitment to courseware is therefore a commitment to personnel and is the largest commitment made in the development of a CAI system. Furthermore, other costs must be a consideration in the development of a CAI system. Included in costs, in addition to personnel and courseware, are hardware, telecommunications, logistics, service and service contracts and research and development. Cost estimates are difficult to address and must be based on an organization's goals, needs and resources. Courseware is 75 percent of the cost of CAI and is increasing relative to the other costs involved.

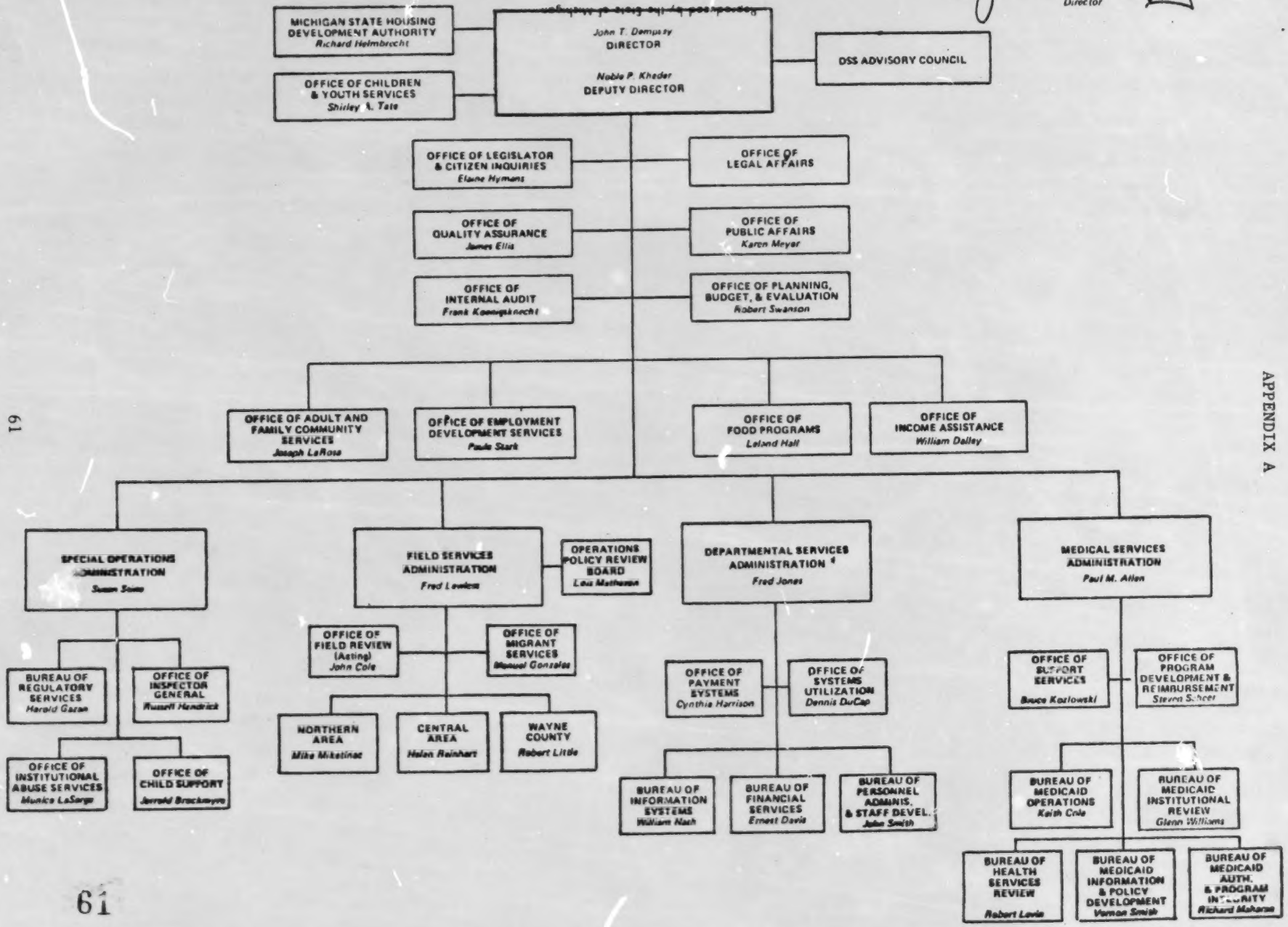
The hypothesis that human service workers would not be receptive to CAI was not supported. Licensing specialists are human service workers and the pilot sample was very positive toward CAI. Apprehensiveness about the equipment was relatively minor. Only 24 percent of the sample said they were apprehensive about using computers. Of the 24 percent who said they were apprehensive, over 70 percent felt positive about the use of computers for staff development and training.

Given the positive attitudes expressed by the licensing specialists in the pilot and the amenability of CAI to licensing and regulation, it would seem that CAI could be incorporated into more areas of licensing training.

Further study is needed in several areas, including whether a pre-orientation to the equipment would be helpful, in development of a less ambiguous questionnaire, in experimenting with the lesson format, in determining the effects of the presence of support staff and in developing approaches to summative evaluations of CAI lessons.

June, 1982
Kalamazoo, Michigan

John T. Dempsey
Director






Effective August, 1980

# "CALCAL" EVALUATION

The following questionnaire is aimed at getting some of your reactions to the experience with CALCAL, "Computer Aided Lessons in Certification and Licensing." Please feel free to provide any additional remarks or comments at any point in this questionnaire.

1. Please identify the lesson(s) which you took during this session:

   [ ] 1. Investigating Licensing Complaints (COMPLA)

   [ ] 2. Licensing, Protective Services, and the Michigan Freedom of Information Act (PSFOIA)

   [ ] 3. Social Work and Regulatory Administration (CLASS)

   [ ] 4. All of the modules

2. Please indicate how much experience in licensing and certification you have had?

   _____Less than six months
   _____Six months to 1 year
   _____One year
   _____Two years
   _____Three or more years

3. Please indicate what percent of your job responsibilities are devoted to licensing and certification procedures: _____Percent

4. Please indicate the amount of previous training you have had in licensing and certification:

   _____No previous training
   _____1-5 hours
   _____6-10 hours
   _____11-15 hours
   _____16-20 hours
   _____21 or more hours

5. Please indicate the source of your training in licensing and certification: (Check either or both)

   _____Within your office
   _____Outside of your office

6. Please indicate whether you have had prior experience in working with a computer:

   _____Yes _____No

If yes, please briefly indicate what type of experience that was:

_____

_____

7. Sex: M_____ F_____

Over



63

In this section, please circle the number above the response which most accurately reflects your opinion.

8. Generally speaking, I am apprehensive about using computers.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

9. Generally speaking, I feel positive about the use of computers for staff development and training.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

10. The performance expectations of the lesson(s) were clear to me.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

11. I have sufficient prior knowledge in certification and licensing to successfully complete the lesson(s).

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

12. The lesson(s) increased my knowledge base in the area of licensing.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

13. The format, or layout, of the lesson(s) was attractive to me.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

14. The structure, or sequence, of the lesson(s) helped me to comprehend the material.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

15. The lesson(s) proceeded at a comfortable pace.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

16. Immediate feedback, provided by the computer, helped me to understand the material.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

17. The lesson(s) satisfactorily addressed important aspects of licensing.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

18. The portable, hard-copy terminal was easy to use.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

19. The hard-copy printout was a useful reference during the lesson(s).

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

20. The hard-copy printout will be a helpful resource for future reference.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

21. The lesson format, with text followed by questions, was an effective way of learning.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

22. The amount of time required to take the lesson(s) was too long.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

23. I generally felt in control of my progress as I moved through the lesson(s).

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

24. The user comment section at the end of the lesson(s) was an adequate opportunity for providing feedback.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

25. While taking the lesson(s), the presence of the project staff made me uncomfortable.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

26. The project staff was an important source of information and support for this learning experience.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

27. Computer aided instruction is a workable and practical way to teach some aspects of licensing and certification.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

28. Computer aided instruction could be used as a supplement to ongoing training.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

29. Computer aided instruction could be used as an orientation program for new licensing workers.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

30. The CALCAL program provided a useful learning experience for me.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

31. I found my experience with CALCAL too impersonal.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

32. I would use this approach to training if it was readily available.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly Disagree | Disagree | Not Sure | Agree | Strongly Agree |

In this section of the questionnaire we'd appreciate your taking the time to answer a few "fill-in" questions:

33. How do you see this approach to training being used in the future?

34. How could the CALCAL experience be improved?

35. Any additional comments?

Thank you for your time and your help?

APPENDIX C

TABLES

A. Distribution of Responses for Demographic Items 1-7.

B. Ratings of Attitudinal Items 8-32.

C. Grouped Responses for Items 8-32.

D. Frequency of Agreement on Selected Attitudinal Ratings by Lesson Options Taken.

E. Frequency of Agreement on Selected Attitudinal Ratings by Amount of Experience.

F. Frequency of Agreement on Selected Attitudinal Ratings by Percent Job Responsibilities.

G. Frequency of Agreement on Selected Attitudinal Ratings by Previous Training.

H. Frequency of Agreement on Selected Attitudinal Ratings by Source of Training.

I. Frequency of Agreement on Selected Attitudinal Ratings by Prior Experience with Computers.

J. Frequency of Agreement on Selected Attitudinal Ratings by Sex of the Respondent.

TABLE A

DISTRIBUTION OF RESPONSES FOR DEMOGRAPHIC ITEMS 1-7

| ITEM NUMBER | SYMBOL | FREQUENCY | | PERCENT OF TOTAL SAMPLE | |
|---|---|---|---|---|---|
| 1 | COMPLA | 4 | | 13.79 | |
| Lesson(s) | PSFOIA | 1 | | 3.45 | |
| | CLASS | 1 | | 3.45 | |
| | COMPLA and PSFOIA | 9 | | 31.03 | |
| | COMPLA and CLASS | 4 | | 13.79 | |
| | PSFOIA and CLASS | 2 | | 6.90 | |
| | ALL | 8 | | 27.59 | |
| | | | 29 | | 100.0 |
| 2 | Less than 6 mths. | 2 | | 6.90 | |
| Experience | 6 mths. to 1 year | 6 | | 20.69 | |
| in | 1 year | 3 | | 10.34 | |
| Licensing | 2 years | 3 | | 10.34 | |
| | 3 or more years | 15 | | 51.72 | |
| | | | 29 | | 100.0 |
| 3 | Missing | 2 | | 6.90 | |
| Job | 1-25 | 9 | | 31.03 | |
| Responsibilities | 26-50 | 6 | | 20.69 | |
| | 51-75 | 3 | | 10.34 | |
| | 76-98 | 9 | | 31.03 | |
| | | | 29 | | 100.0 |
| 4 | No previous training | 3 | | 10.34 | |
| Previous | 1-5 hrs. | 5 | | 17.24 | |
| Training | 6-10 hrs. | 5 | | 17.24 | |
| | 11-15 hrs. | 8 | | 27.59 | |
| | 16-20 hrs. | 1 | | 3.45 | |
| | 21 or more hrs. | 7 | | 24.14 | |
| | | | 29 | | 100.0 |
| 5 | Missing | 2 | | 6.90 | |
| Source of | Within your office | 5 | | 17.24 | |
| Training | Outside your office | 13 | | 44.83 | |
| | Both | 9 | | 31.03 | |
| | | | 29 | | 100.0 |
| 6 | Yes | 9 | | 31.03 | |
| Computer | No | 20 | | 68.97 | |
| Experience | | | 29 | | 100.0 |
| 7 | Male | 7 | | 24.14 | |
| Sex | Female | 22 | | 75.86 | |
| | | | 29 | | 100.0 |

TABLE B

RATINGS OF ATTITUDINAL ITEMS 8-32

| ITEM NUMBER | MEAN | VARIANCE | STANDARD DEVIATION |
|---|---|---|---|
| 8 | 2.41 | 1.25 | 1.11 |
| 9 | 3.96 | 0.46 | 0.68 |
| 10 | 4.13 | 0.26 | 0.51 |
| 11 | 4.20 | 0.24 | 0.49 |
| 12 | 3.86 | 0.76 | 0.87 |
| 13 | 3.68 | 0.43 | 0.66 |
| 14 | 3.93 | 0.28 | 0.52 |
| 15 | 4.06 | 0.56 | 0.75 |
| 16 | 4.27 | 0.34 | 0.59 |
| 17 | 3.96 | 0.33 | 0.57 |
| 18 | 4.31 | 0.29 | 0.54 |
| 19 | 4.27 | 0.42 | 0.64 |
| 20 | 3.72 | 1.13 | 1.06 |
| 21 | 4.10 | 0.38 | 0.61 |
| 22 | 2.27 | 0.63 | 0.79 |
| 23 | 4.17 | 0.29 | 0.53 |
| 24 | 3.70 | 0.60 | 0.77 |
| 25 | 1.89 | 0.59 | 0.77 |
| 26 | 3.89 | 0.32 | 0.56 |
| 27 | 4.00 | 0.57 | 0.75 |
| 28 | 4.27 | 0.20 | 0.45 |
| 29 | 3.75 | 1.04 | 1.02 |
| 30 | 4.03 | 0.32 | 0.56 |
| 31 | 4.17 | 0.43 | 0.65 |
| 32 | 3.96 | 0.39 | 0.62 |

TABLE C

GROUPED RESPONSES FOR ITEMS 8-32*
(percent)

| ITEM NUMBER | AGREE | DISAGREE | NOT SURE |
|---|---|---|---|
| 8 | 24.14 | 68.97 | 6.90 |
| 9 | 75.86 | - | 24.14 |
| 10 | 93.10 | - | 6.90 |
| 11 | 96.55 | - | 3.45 |
| 12 | 75.86 | 10.34 | 13.79 |
| 13 | 72.41 | 6.90 | 20.69 |
| 14 | 89.66 | 3.45 | 6.90 |
| 15 | 89.66 | 6.90 | 3.45 |
| 16 | 93.10 | - | 6.90 |
| **17 | 86.21 | 3.45 | 6.90 |
| 18 | 96.55 | - | 3.45 |
| 19 | 96.55 | 3.45 | - |
| 20 | 58.62 | 10.34 | 31.03 |
| 21 | 86.21 | - | 13.79 |
| 22 | 10.34 | 82.76 | 6.90 |
| 23 | 93.10 | - | 6.90 |
| **24 | 62.07 | 6.90 | 24.14 |
| 25 | 6.90 | 89.66 | 3.45 |
| **26 | 82.76 | 3.45 | 10.34 |
| 27 | 79.31 | 3.45 | 17.24 |
| 28 | 100.00 | - | - |
| 29 | 75.86 | 10.34 | 13.79 |
| 30 | 86.21 | - | 13.79 |
| 31 | 3.45 | 75.86 | 20.69 |
| 32 | 79.31 | - | 20.69 |

*Agree = 4 or 5 rating; Disagree = 1 or 2 rating; Not Sure = 3

**Represents missing data

TABLE D

FREQUENCY OF AGREEMENT ON SELECTED ATTITUDINAL RATINGS, BY LESSON OPTIONS TAKEN

Lessons

| Items | COMPLA (N=4) | PSFOIA (N=1) | CLASS (N=1) | COMPLA PSFOIA (N=9) | COMPLA CLASS (N=4) | PSFOIA CLASS (N=2) | ALL (N=8) |
|---|---|---|---|---|---|---|---|
| 11 (SUFIC) | 4 | 1 | 1 | 9 | 4 | 1 | 8 |
| 12 (KNOWL) | 2 | 1 | 1 | 7 | 2 | 2 | 7 |
| 27 (WORK) | 2 | 0 | 1 | 8 | 3 | 2 | 7 |
| 28 (SUPPL) | 4 | 1 | 1 | 9 | 4 | 2 | 8 |
| 29 (ORIEN) | 2 | 1 | 1 | 8 | 2 | 2 | 6 |
| 30 (USEFU) | 3 | 0 | 1 | 8 | 3 | 2 | 8 |
| 32 (WOULD) | 2 | 0 | 1 | 7 | 3 | 2 | 8 |

TABLE E

FREQUENCY OF AGREEMENT ON SELECTED ATTITUDINAL RATINGS, BY AMOUNT OF EXPERIENCE

| Items | Experience: Less than six months (N=2) | Six months to 1 year (N=6) | One year (N=3) | Two years (N=3) | Three or more years (N=15) |
|---|---|---|---|---|---|
| 8 (APPRE) | 0 | 1 | 1 | 0 | 5 |
| 9 (POSIT) | 2 | 4 | 2 | 2 | 12 |
| 12 (KNOWL) | 2 | 6 | 3 | 0 | 11 |
| 17 (ADDRE) | 2 | 4 | 2 | 2 | 15 |
| 27 (WORK) | 2 | 5 | 2 | 2 | 12 |
| 28 (SUPPL) | 2 | 6 | 3 | 3 | 15 |
| 29 (ORIEN) | 2 | 4 | 3 | 1 | 12 |
| 30 (USEFU) | 2 | 6 | 3 | 3 | 11 |
| 32 (WOULD) | 2 | 6 | 2 | 2 | 11 |

TABLE F

FREQUENCY OF AGREEMENT ON SELECTED ATTITUDINAL RATINGS, BY PERCENT JOB RESPEONSIBILITIES

| Items | Job Responsibilities 1-25 (N=9) | 26-50 (N=6) | 51-75 (N=3) | 76-100 (N=9) |
|---|---|---|---|---|
| 12 (KNOWL) | 7 | 4 | 2 | 7 |
| 17 (ADDRE) | 9 | 4 | 2 | 8 |
| 28 (SUPPL) | 9 | 6 | 3 | 9 |
| 29 (ORIEN) | 7 | 5 | 1 | 7 |
| 30 (USEFU) | 8 | 4 | 3 | 8 |
| 32 (WOULD) | 8 | 4 | 3 | 6 |

TABLE G

FREQUENCY OF AGREEMENT ON SELECTED ATTITUDINAL RATINGS, BY PREVIOUS TRAINING

| Items | No previous training (N=3) | 1-5 hours (N=5) | 6-10 hours (N=5) | 11-15 hours (N=8) | 16-20 hours (N=1) | 21 or more hours (N=7) |
|---|---|---|---|---|---|---|
| 8 (APPRE) | 1 | 2 | 1 | 1 | 0 | 2 |
| 9 (POSIT) | 3 | 3 | 2 | 6 | 1 | 7 |
| 11 (SUFIC) | 2 | 5 | 5 | 8 | 1 | 7 |
| 12 (KNOWL) | 3 | 4 | 3 | 6 | 1 | 5 |
| 17 (ADDRE) | 3 | 2 | 5 | 8 | 1 | 6 |
| 27 (WORK) | 3 | 3 | 4 | 7 | 1 | 5 |
| 28 (SUPPL) | 3 | 5 | 5 | 8 | 1 | 7 |
| 29 (ORIEN) | 2 | 5 | 3 | 6 | 0 | 6 |
| 30 (USEFU) | 3 | 4 | 4 | 8 | 1 | 5 |
| 32 (WOULD) | 3 | 4 | 2 | 7 | 1 | 6 |

TABLE H

FREQUENCY OF AGREEMENT ON SELECTED ATTITUDINAL RATINGS, BY SOURCE OF TRAINING

| Items | Source of Training: Inside the office (N=5) | Outside the office (N=13) | Both (N=9) |
|---|---|---|---|
| 27 (WORK) | 5 | 10 | 6 |
| 28 (SUPPL) | 5 | 13 | 9 |
| 29 (ORIEN) | 3 | 10 | 7 |
| 30 (USEFU) | 4 | 12 | 7 |
| 32 (WOULD) | 4 | 10 | 7 |

TABLE I

FREQUENCY OF AGREEMENT ON SELECTED ATTITUDINAL RATINGS, BY PRIOR EXPERIENCE WITH COMPUTERS

| Items | Prior Computer Experience: Yes (N=9) | Prior Computer Experience: No (N=20) |
|---|---|---|
| 8 (APPRE) | 1 | 6 |
| 9 (POSIT) | 7 | 15 |
| 18 (TERM) | 9 | 19 |
| 26 (SUPPO) | 9 | 15 |
| 28 (SUPPL) | 9 | 20 |
| 29 (ORIEN) | 8 | 14 |
| 30 (USEFU) | 9 | 16 |
| 31 (IMPER) | 6 | 16 |
| 32 (WOULD) | 8 | 15 |

TABLE J

FREQUENCY OF AGREEMENT ON SELECTED ATTITUDINAL RATINGS, BY SEX OF THE RESPONDENT

| Items | Sex of the Respondent: Male (N=7) | Female (N=22) |
|---|---|---|
| 8 (APPRE) | 1 | 6 |
| 9 (POSIT) | 6 | 16 |
| 31 (IMPER) | 0 | 1 |
| 32 (WOULD) | 7 | 16 |

*APPENDIX D

## LIST OF PARTICIPANTS

| NAME | AGENCY | CITY/STATE |
|---|---|---|
| Allan, Jane | Family & Children Services of Calhoun County | Battle Creek, MI |
| Bassar, Joanne | Ingham County Department of Social Services | Lansing, MI |
| Bettanzos, Berta | Child & Family Services of the Capitol Area | Lansing, MI |
| Borst, Daniel | Bethany Christian Services | Grand Rapids, MI |
| Brundage, Nancy | Family & Children Services of Kalamazoo | Kalamazoo, MI |
| * Bresz, Maggie | St. Joseph County Department of Social Services | St. Joseph, MI |
| Budden, Julie | Catholic Social Services of Grand Rapids | Grand Rapids, MI |
| Caine, Michael | Catholic Social Services | Lansing, MI |
| Cook, Daniel | Van Buren County Department of Social Services | Hartford, MI |
| DelaCruz, Isabelle | Berrien County Juvenile Court | Benton Harbor, MI |
| Gillette, Mary | Area Youth for Christ | Battle Creek, MI |
| Frederick, Mary | Kalamazoo County Department of Social Services | Kalamazoo, MI |
| French, Nancy | Calhoun County Department of Social Services | Battle Creek, MI |
| Fricki, Ruth | Child & Family Services Southwest Branch | St. Joseph, MI |
| Harmon, Steve | Berrien County Department of Social Services | Benton Harbor, MI |
| Johns, Anette | Catholic Family Services | Kalamazoo, MI |
| Kaiser, Larry | Calhoun County Community Mental Health | Battle Creek, MI |

| | | |
|---|---|---|
| McLean, Barbara | Lutheran Social Services | Lansing, MI |
| Meadowcraft, Marilyn | Family Services and Children's Aide | Jackson, MI |
| Ostrander, Jeff | Riverview Residential Treatment Facility | Lowell, MI |
| Palmiter, Peggy | Lutheran Social Services | Lansing, MI |
| Ranville, Sandra | Jackson County Department of Social Services | Jackson, MI |
| Reiffer, Gayle | D.A. Blodgett Homes for Children | Grand Rapids, MI |
| Schrader, Phyllis | Cass County Department of Social Services | Cassopolis, MI |
| Shaltis, Barbara | Family Services and Children's Aid | Jackson, MI |
| Villet, Wanda | Ionia County Department of Social Services | Ionia, MI |
| Wittel, Norma | Jackson-Hillsdale Mental Health Board | Jackson, MI |
| Wouldstra, Jim | Kent County Department of Social Services | Grand Rapids, MI |
| Wynalda, Lavina | Honey Creek Christian Home | Lowell, MI |
| Yolles, Constance | Kent Client Services | Grand Rapids, MI |

*Unable to complete lessons due to equipment failure.

# BIBLIOGRAPHY

Anderson, Ronald E. "Courseware Deserves Evaluation Including Peer Review." AEDS Monitor, 1982, 20, 10.

Asp, Elaine H., & Gordon, Joan. "Development of a Computer Assisted Program for Undergraduate Instruction." Journal of Nutrition Education, 1981, 13(1), 91-95.

Atkinson, Richard C. "Futures: Where will Computer-Assisted Instruction be in 1990?" Educational Technology, 1978, 18(4), 60-63.

Austin, David. "Computer Assisted Instruction." Momentum, 1978, 9(2), 16-20.

Avner, R.A. "Cost-Effective Applications of Computer-Based Education." Educational Technology, 1978, 18(4), 24-26.

Bagley, Carole. "CAI Update: So you want to do CAI?" NSPI Journal, 1979, 18(2), 35-36.

Bagley, Carole A. & Klasson, Daniel. "Instructional Computing in Correctional Institutions." Educational Technology, 1979, 19(4), 37-40.

Blaschke, Charles L. "Microcomputer Software Development for Schools: What, Who, How?" Educational Technology, 1979, 19(10), 26-28.

Bingham, Margaret. "Software Evaluation: A Coordinated Effort Needed." AEDS Monitor, 1982, 20, (10,11,12), 11.

Bork, Alfred. "The Role of Personal Computer Systems in Education." AEDS Journal, 1979, 13(1), 17-30.

Bork, Alfred & Franklin, Stephen. "Personal Computers in Learning." Educational Technology, 1979, 19(10), 7-12.

Bozeman, William C. "Human Factors and Considerations in the Design of Systems of Computer Managed Instruction." AEDS Journal, 1978, 11(4), 89-96.

Bozeman, William C. "Computer Managed Instruction--It is a System for Your School?" Technological Horizons in Education, 1979, 6(4), 50-53.

Bozeman, William C. "Computer Managed Instruction: State of the Art." AEDS Journal, 1979, 12(3), 117-137.

Bramer, May. "Using Computers in Distance Education: The First 10 Years of the British Open University." Computers and Education, 1980, 4(4), 293-301.

Bunderson, C.V., et al. "Work Models: Beyond Instructional Objectives." Instructional Science, 1981, 10(3), 205-215.

Caldwell, Robert M. "Guidelines for Developing Basic Skills in Instructional Materials for use with Microcomputer Technology." Educational Technology, 1980, 20(10), 7-12.

Callison, William, "The Potential Is Great: Problems and Possibilities for Computer-Assisted Instruction." NASSP Bulletin, 1981, 65(445), 24-28.

Carrier, Carol A. "The Role of Learner Characteristics in Computer Based Instruction." NSPI Journal, 1978, 18(5), 25-32.

Class, Norris. "Social Work and the Regulatory State: An Inquiry into the Historical Dynamics of Isolationism within the Profession." Social Work Papers of the School of Social Work, U.S.C. Los Angeles: University of Southern California, Vol. XIII, 1975, 18-27.

Collagon, Robert B. "A Programming Primer." School Science and Mathematics, 1976, 76(5), 381-391.

Crease, Allan. "Developing CAL for Undergraduate Science Teaching." Physics Education, 1977, 12(1), 48-51.

Daneliuk, Carl & Wright, Annette. "Instructional Uses of Micro-computers: The Why, What, and How of the B.C. Approach." Education Canada, 1981, 21(3), 4-11.

DeLaurentis, Emiliano. "Learning by Interactive Programming: Microcomputer Applications." Educational Technology, 1980, 20(12), 10-14.

Dence, Marie. "Toward Defining the Role of CAI: A Review." Educational Technology, 1980, 20(11), 50-54.

Doelker, Richard E., Jr. "Computer Based Education: Its Application to Competency Based Education in Social Work." Social Perspectives, 1978, 6(1), 5-10.

Douglas, Charles H. & Edwards, John S. "A Selected Glossary of Terms Useful in Dealing with Computers." Educational Technology, 1979, 19(10), 56-66.

Eisele, James. "Lesson Design for Computer-Based Instructional Systems." Educational Technology, 1978, 18(9), 14-21.

Eisele, James E. "Classroom Use of Microcomputers." Educational Technology, 1979, 19(10), 7-12.

Eisele, James E. "A Case for Computers in Instruction." Journal of Research and Development in Education, 1980, 14(1), 1-8.

Forman, Denyse. "Courseware Evaluation for Curriculum Integration." AEDS Monitor, 1982, 20(10,11,12), 7-9.

Flynn, John P. "Research Processes for System Change and School Social Work Services." In Robert T. Constable and John P. Flynn (Eds.), School Social Work: Practice and Research Perspectives. Homewood, Ill: Dorsey Press, 1982, 321-331.

Flynn, John P., French, Nancy, Brown, Carol, Howley, Larry & Stuart, Isabell. "Orientation and Training in Regulation of Out-of-Home Care: Staff Attitudes and Needs." Field Studies in Research and Practice, 1981, School of Social Work, Western Michigan University.

Frantz, Nevin R. "Using Computer Managed Instruction for Staff Development at a Technical and Community College." Technological Horizons in Education, 1979, 6(3), 30-31.

Graham, Neill. The Mind Tool: Computers and Their Impact on Society. St. Paul, Minnesota: West Publishing Company, 1980.

Gull, Randall L. "A Successful Transition from Mini- to Micro-Computer-Assisted Instruction: The Norfolk Experience." Educational Technology, 1980, 20(12), 41-42.

Hazen, Margaret. "An Argument in Favor of Multi-method Research and Evaluation in CAI and CMI Instruction." AEDS Journal, 1980, 13(4), 275-284.

Hebenstreit, Jacques. "10,000 Microcomputers for French Secondary Schools." Computor, 1980, 13(7), 17-21.

Huntington, J.F. "Microcomputers and University Teaching." Improving College and University Teaching, 1980, 28(2), 75-77.

Ingle, Earl B., & Musterman, Richard E. "CMI, CAI: What are they and What's in it for Us?" Kappa Delta Pi Record, 1976, 13(2), 46-48.

Joiner, Lee Marvin, Miller, Sidnay R., & Silverstein, Burton S. "Potential and Limits of Computers in Schools." Educational Leadership, 1980, 37(6), 498-501.

Jostad, Karen. "Search for Software." AEDS Monitor, 1982, 20(10,11,12), 25.

Kearsley, Greg P. "Some 'Facts' About CAI Trends 1970-76." School Science and Mathematics, 1976, 76(5), 381-391.

Kearsley, Greg P. "The Cost of CAI: A Matter of Assumption." AEDS Journal, 1977, 10(4), 100-112. (a)

Kearsley, Greg P. "Some Conceptual Issues in Computer-Assisted Instruction." Journal of Computer-Based Instruction, 1977, 4(1), 8-16. (b)

Kidder, Louise. Research Methods in Social Relations (4th ed.). New York: Holt, Rinehart and Winston, 1981.

Leiblum, Mark D. "Organizing for Computer-Assisted Learning." Educational Technology, 1979, 19(9), 7-10.

Levin, Hendy M. & Woo, Louis. "An Evaluation of the Costs of Computer-Assisted Instruction." Economics of Education Review, 1981, 1(1), 1-25.

Lockhart, Kathleen A., et al. Computer-Managed Instruction in the Navy: IV. The Effects of Test Item Format on Learning and Knowledge Retention. San Diego, California: Navy Personnel Research and Development Center, 1981.

MacDonald, Barry. "The Educational Evaluation of NDPCAL." British Journal of Educational Technology, 1977, 8(3), 176-189.

Magidson, Errol M. "One More Time: CAI is not Dehumanizing." Audiovisual Instruction, 1977, 22(8), 20-21.

McCann, Patrick H. "Learning Strategies and Computer-Based Instruction." Computers and Education, 1981, 5(3), 133-140.

McCulloch, D.W. "The Effects of Instruction Software--Analysis and Implications." Computers and Education, 1979, 3(2), 293-294.

Michigan Department of Social Services. FY 79-81 Biennial Report. Bureau of Regulatory Services, Michigan Department of Social Services, DSS Publication 369 (Rev. 1-82).

Michigan Department of Social Services. Licensing Rules for Child Placing Agencies. State of Michigan, Department of Social Services, DSS Publication 11 (Rev. 12-80).

Michigan Department of Social Services. Licensing Rules for Foster Family Homes and Foster Family Group Homes for Children. State of Michigan, Department of Social Services, DSS Publication 10 (Rev. 3-80).

Michigan Department of Social Services. 1981-1982 Annual Plan. State of Michigan, Department of Social Services, DSS Publication 313 (Rev. 9-81).

Misselt, A. Lynn, et al. Implementation and Operation of Computer-Based Education. MTC Report No. 25. Final Report. Urbana: University of Illinois Computer-Based Education Research Lab., 1980, 48pp.

Mudson, William J. "Computer-Based Training (CBI): Buying Criteria." CTM: The Human Element, 1981, 14(2), 27-29.

Nelson, Edward G. "Individualized Instruction: Another Point of View." Balance Sheet, 1978, 60(3), 122-125.

Otte, Richard B. "A Federal Perspective Concerning the Use of Computers in Vocational Training." Journal of Educational Technology Systems, 1978-79, 7(3), 221-228.

Overton, Victoria. "Research and Instructional Computing and Mathematics Education." Viewpoints in Teaching and Learning, 1981, 57(2), 23-36.

Patrick, John & Stammers, Robert. "Computer Assisted Learning and Occupational Training." British Journal of Educational Technology, 1977, 8(3), 253-267.

Peters, Harold J. & Hepler, Molly H. "Reflections on Ten Years of Experience." AEDS Monitor, 1982, 20(10,11,12), 12-24.

Rudnick, Martin F. "Now You Can Program the Computer in English." Audiovisual Instruction, 1979, 24(4), 36-37.

Sakamoto, T. "Evaluation Methods for Improving CAI Materials." Computers and Education, 3(4), 281-291.

Sasscer, Monica Flynn. "Computer Assisted Instruction at Northern Virginia Community College: Integrating TICCIT into the Instructional Program." Journal of Educational Technology, 1978-79, 7(3), 287-297.

Schoech, Dick. Computer Use in Human Services. New York: Human Science Press, 1982.

Schoen, Harold L. & Hunt, Thomas C. "The Effect of Technology on Instruction: The Literature of the Last 20 Years." AEDS Journal, 1977, 10(3), 68-82.

Schuyler, Janis A. "Programming Languages for Microprocessor Coursewa-e." Educational Technology, 1979, 19(10), 29-35.

Seidel, Robert J., et al. "Tips for Managing CAI Projects." Educational Technology, 1978, 18(4), 33-37.

Skinner, Steven J. & Grimm, Jim L. "Computer-Assisted Instruction Case Study: The Introductory Marketing Course." Educational Technology, 1979, 19(7), 34-36.

Smith, Joan McKeornan & von Feidt, James R. "A Comparison of Two Media: CAI and Instructional Television." Journal of Studies in Technical Careers, 1979, 1(2), 119-127.

Sorlie, William E. & Essex, Diane L. "So You Want to Develop a Computer-Based Instruction Project? Some Recommendations to Consider First." Educational Technology, 1979, 19(3), 53-57.

Splittberger, Fred L. "Computer Based Instruction: A Revolution in the Making?" Educational Technology, 1979, 19(1), 20-26.

Spuck, Dennis W. & Bozeman, William C. "Pilot Test and Evaluation of a System of Computer-Managed Instruction." AEDS Journal, 1978, 12(1), 31-41.

Stahl, Robert M. "Tomorrow's Education (Whether You're Ready or Not)." Audiovisual Instruction, 1979, 24(8), 20-21.

Suppes, Patrick & Macken, Elizabeth. "The Historical Path From Research and Development to Operational Use of CAI." Educational Technology, 1978, 18(4), 9-12.

Svenson, Raynold A. "How to Determine the Strategic Potential of Computer-Based Instruction in Your Training/Education Department." Technological Horizons in Education, 1981, 8(3), 36-38.

Talsnoka, Kikumi K. & Misselt, A. Lynn (Eds.). Attitude and Performance of Military Students and Instructor Attitude in Computer-Based Technical Training. MTC Report No. 23. Urbana: University of Illinois Computer-Based Education Research Lab., 1978, 54 pp.

Tennyson, Robert D. & Rothen, Wolfgang. "Pretask and On-Task Adaptive Design Strategies for Selecting Number of Instances in Concept Acquisition." Journal of Educational Psychology, 1977, 69(5), 586-592.

Thoma-. David B. "The Effectiveness of Computer-Assisted Instruction in Secondary Schools." AEDS Journal, 1979, 12(3), 103-116.

Tobias, Sigmund. "Achievement Treatment Interactions." Review of Educational Research, 1976, 46(1), 61-74.

Wager, Walter. "The Software Evaluation Dilemma." AEDS Monitor, 1982, 20(10, 11,12), 5-6.